THE
METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
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Metals Are Indispensable in the Air

The Use of Heavy Non-Ferrous Metals and Alloys in Modern Aircraft

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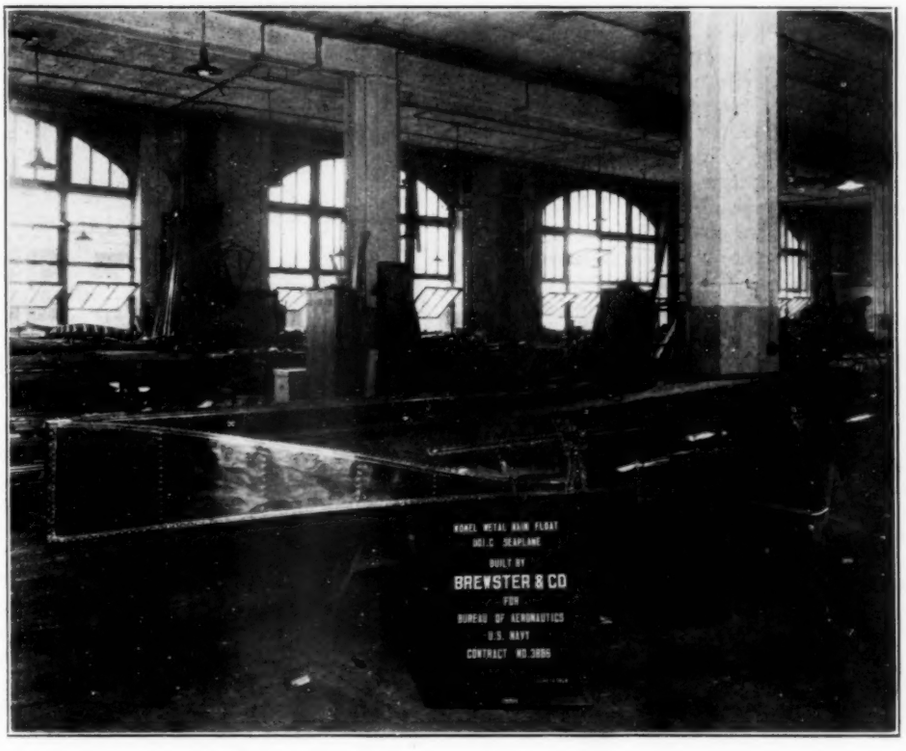
WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

JUST a little over twenty-five years ago the Wright Brothers made the first flight in a heavier than air machine at Kitty Hawk, N. C. When we view the kaleidoscopic picture of the almost unbelievable transition from the puny bamboo stick and wire construction of pioneer days to the all-metal air giants of today, with their Pullman-like accommodations for twenty passengers or more, we are seeing at the same time a quarter century of the most amazing developments in materials the world has ever known. True, this passage has been marked chiefly by the change from wood to alloy steels and the lighter non-ferrous alloys in all phases of aircraft construction. This almost magical story is too well known to bear repetition here. The light aluminum alloys have contributed a glorious major chapter to aeronautical development. The airplane demands maximum strength for minimum weight—it is the law. Literally, the sky is the limit in the choice of aeronautical materials, and the lighter the material, the higher and farther you go.

Far less spectacular, but equally amazing if we but appreciate the picture, has been the persistence of the heavier non-ferrous metals and alloys in aircraft use. Frankly, the airplane designer would gladly reject them on the basis of weight, but he dare not do so because of the other excellent properties which they possess, and which cannot be duplicated in the materials of lesser density or greater strength-weight ratio. In fact, as the demands for longer life in the modern airplane increase, we find the beginning of a significant trend toward these heavier metals and alloys for their corrosion and wear resisting properties.



Monel Metal Float for Seaplane

As compared to the aluminum alloys and alloy steels, the use of the heavier non-

ferrous metals and alloys in airplanes bulks relatively small. But when we consider the amazing growth of aeronautical activity in the last few years, even this relatively small percentage of use bulks large in total volume. Aviation in America has already reached the proportions of a $100,000,000 industry and airplane transportation has within two years become a positive factor of industry and commerce. During the year 1927 the total number of airplanes made in this country was less than 2,000, including those for the Army, Navy and Postal Departments, as well as those for commercial requirements. During 1928, the production reached 5,000 planes, an increase of 150 percent. So with this rapid expansion of aviation activity, there is a distinctly worth while market for the manufacturers of the heavier non-ferrous metals and alloys.

In order to convey a composite panoramic view of the rather diversified uses of these heavier metals and alloys, they will each be briefly discussed in turn in terms of their aeronautical uses. Despite their obvious handicap of weight, careful design with due recognition of their special and highly desirable other properties, have made them highly acceptable aeronautical materials.

Copper

Copper, with a specific gravity of 8.9, is one of the heaviest metals used in aircraft work. The fact that it is tough and strong, yet malleable, ductile and flexible, together with the fact that it is second only to silver as a conductor of heat and electrical energy, contributes greatly to its desirability for a diversity of uses. In addition to its many direct uses, and its useful heavy alloys, it is an important alloying constituent, and even in the lighter alloys, such as Duralumin, it is an important factor in chemical composition. Its resistance to corrosion, fair strength, flexibility and ease of working all contribute to the value of this metal for aeronautical activity. In electrical work its high conductivity and reasonable price more than balances the weight consideration.

Copper tubing is the prevailing material for fuel, oil and water lines. A soft annealed seamless copper tubing, with 99.88% copper, with silver counting as copper is used. It is usually submitted to flattening, crushing, bending and hydrostatic tests before it is accepted for this use. Despite the occasional use of aluminum and aluminum alloy tubing for fuel and oil lines, and steel tubing for water lines, copper has been able to maintain its leadership from the very beginning. Its non-corrosive properties, ease of working for the mechanic, low cost and wear resistance are the chief factors in maintaining its position. It is used in all diameters, usually with a wall thickness of No. 20 (.035) B. W. G. Copper tubing is also used for priming lines, air speed and turn indicator instrument leads, radiator cores and heater coils, and in the manufacture of cable terminals for electrical connections.

In sheet form or strips, ease of fabrication by sweating and riveting is an important additional asset of copper. It has been used in the manufacture of gas and oil tanks, and is used extensively for radiator shells for water cooled engines. Copper strip is used for flashing on wooden bulls and floats to take the chafing wear and also for tipping wooden propellers. Copper ribbon is sometimes used for the radio bonding for a plane structure, and copper sheet for the clips, brackets and angles used in radio construction. In addition, shims and washers made from sheet copper are frequently used.

In wire or cable form, copper is used for ignition, radio and lighting wires, due to its high conductivity. A soft copper wire, with 36,000 to 40,000 lbs. per sq. in. maximum tensile strength and a corresponding minimum elongation of 35 to 20% in 10 inches, depending upon diameter, is used for locking wire in airplane construction. Copper wire is sometimes used for radio bonding. Wire is also used in the manufacture of copper tacks and split rivets, as well as for tinned copper rivets for tank construction and purlin nails for wood fabrication.

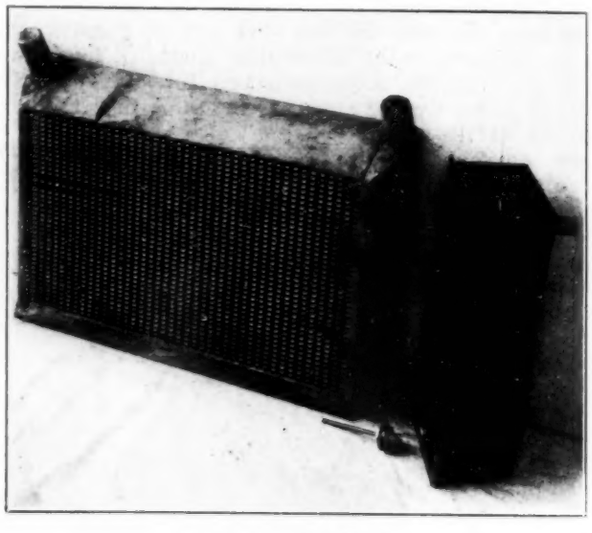
Brasses and Bronzes

Brasses and bronzes constitute the two principal classes of copper alloys and are both used in various forms and to various degrees in aircraft work. While the distinction between them is often not finely drawn, it will be generally borne in mind through this discussion that the true brasses are solid solutions of zinc in copper, whereas the true bronzes are solid solutions of tin in copper, and that the principal alloying elements of complex brasses are aluminum, iron, lead, magnesium, manganese, nickel, silicon and tin and those of the special bronzes are zinc, lead and phosphorous.

True Brasses

The true brasses will be roughly classified as those copper-zinc alloys in which the copper content is greater than 49 per cent. The valuable alloys for aircraft use contain from 60 to 90 percent copper and 10 to 40 percent zinc. These brasses are stronger and more ductile than either of their constituents but show much lower conductivity to electricity than does copper. These brasses may be cast or wrought, depending upon their aeronautical application.

70-30 brass, also called "cartridge brass", is employed in aircraft construction for brazing, which is an important method of fabrication for steel parts, and in both wrought and cast forms. As sheets it is used for parts



Brass Aircraft Radiator

requiring spinning as well as for rubbing strips, wooden propeller tipping and the like. In cast form it is used as fittings for tanks, radiators, heaters, etc. Its good resistence to corrosion and excellent cold working properties are its chief assets.

60-40 brass, often called Muntz metal is used for bolts, rods, tubes and various extruded shapes. It has the disadvantage that while it is readily hot worked, it hardens considerably when cold worked with the consequent liability of cracking.

Complex Brasses

The complex brasses are many and varied. Their use in aircraft is often determined by highly specialized re-

quirements, similar to those which dictate their application in other industries. A brief summing of their principal uses is listed below.

Manganese bronze may well be termed a brass containing very small percentages of tin, iron and manganese. Owing to its high strength (approximately 80,000 lbs. per sq. in.), the facility with which it may be forged or rolled, and its resistance to corrosion, manganese bronze is sometimes used for landing gear and tail skid fittings, caps, brackets, etc.

Naval brass is used for similar purposes and is much like manganese bronze in composition except that it lacks manganese and has only a trace of iron and sometimes aluminum. The wrought material is used for turnbuckle barrels owing to its excellent resistance to corrosion, ready machinability and high tensile strength (62,000 to 67,000 lbs. per sq. in.). The specifications for turnbuckle barrel use are very rigid and require several very exacting tests. In wire form it is used for the manufacture of clinch nails, which have become the accepted means of fabricating bottom and deck planking for wooden hulls and floats.

Bronzes

The true bronzes, since they are really hardened copper, with the tin acting as a hardener with very little effect on strength, have really no useful field in aeronautical work. This is easily understood when we bear in mind that up to 20 per cent tin content the strength improves slightly but beyond this point it drops sharply, and that the elongation reaches a maximum at 5 per cent tin content, beyond which point it drops quickly to nothing at 20 per cent. The complex bronzes are in fairly general use in aircraft work. The alloying constituents previously mentioned improve the properties considerably. The principal bronzes used are cited in the following comment:

Gun metal is a prominent casting alloy and bearing material, being one of the strongest bronzes. It is used for bearings, bushings and the like such as wrist pin bearings, wheel bushings, etc.

Red brass or ounce metal is a readily machined bronze, moderately strong and fairly ductile, having an elongation of 20 percent in two inches, and a tensile strength of 30,000 lbs. per sq. in. It is generally used for fuel and oil line fittings, valves and cocks, pump bodies, etc. Fuel and oil line fittings constitute an important field in aircraft use. These fittings take various commercial forms, such as compression fittings, brazing fittings, flare fittings, etc. A special collection of such fittings designed especially for aeronautical power plant use is shown in the accompanying photograph.

Phosphor Bronze is sometimes used for castings as well as being drawn into rod and wire. Phosphor bronze springs are often used for various aeronautical purposes.

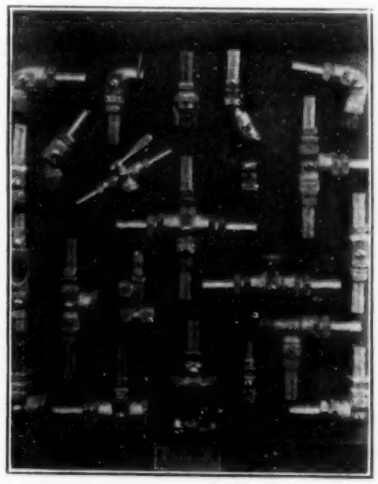
The foregoing gives some of the specialized uses of brasses and bronzes. In general, and often in simply the commercial grade, we have brass machine screws and nuts for mounting and installation purposes, brass wood screws and cement coated nails for wood fabrication, brass cotter pins for locking all castellated nuts or bolts and clevis pins, brass drain plugs for hulls and floats, brass wire for springs and locking purposes, and occasionally brass gears, sprockets, chains (sprocket and safety), bushings, oil and gas tanks, etc. The various bronzes, are also more specifically used in the manufacture of bushings for the various drive shafts for water pumps, gas pumps, oil pumps, starters, generators, magnetos, piston pins, link pins, and connecting rods, as well as for valve guides and for wire mesh used in strainers.

Monel Metal

Monel metal, which is essentially a nickel copper alloy, combines strength and stiffness with inherent resistance to the forms of corrosion encountered by airplane parts. On a strength-weight ratio basis, hardened Monel metal gives higher values than does aluminum, carbon steel and certain heats of alloy steel and only 25% lower than Duralumin. The resistance to corrosion is the most significant property, as the means of protection used with steel and the light alloys are not needed, and, even more important, the weakening of structural parts that accompanies even the slightest amount of corrosion is avoided. It is not subjected to the intercrystalline embrittlement characteristic of cold-worked brass and of the light alloys, or to the pitting frequently occurring with the ferrous metals and the light metals. The lowering of strength occasioned by pitting is very much out of proportion to the actual decrease in section caused by the pits, and therein is the real seriousness of the matter.

On a purely mechanical basis the light alloys and the steels would satisfy the greater part of the requirements of the airplane industry. However, it is the modification of these mechanical properties by occasional chemical deterioration, that occasions the consideration of the corrosion resisting alloys like Monel metal, which, while they may at the first glance appear to have inferior mechanical properties, are far more stable in the long run.

Monel metal has been used for exhaust manifolds, and in a limited experimental way, for gasoline and oil tanks. It is also used for propeller sheathing, carburetor needles, sleeves, etc. "Monel-plymetl," a combination of plywood core with metal faces, has been used for instrument boards. In Australia, Monel wheels, including rims, spokes and hubs are used. Bolts, nuts, control parts and fittings have on some occasions been made of Monel metal.



Brass Tube Fittings

A very interesting application has been in the recent construction by Brewster and Company of two all-Monel metal seaplane floats (see page 315) which do not exceed the weight of analagous Duralumin floats by 10% and require no protective coating. This relatively slight increase in weight is a good indication of what careful designing may accomplish, and it is not unreasonable to suppose, that when airplane designers become more familiar with the properties of Monel metal, that weight increase in a complete unit fabricated of this material will be negligible.

Babbitt, an essentially tin, copper, and antimony alloy, is used as a bearing metal against a backing of steel, phosphor bronze or Duralumin. In fact the development of steel babbitt is an outstanding feature in aircraft engine design. It is a big improvement over the old practice of using bronze for a backing, as the steel backing improves and supports the rigidity of the crankshaft and supports the comparatively light construction of the connecting rod big end.

Miscellaneous Heavy Metals

Tin is used as a coating for tin plate, and in conjunction with lead, as a coating for terne plate, both of which plates find a considerable usage for tank construction. Copper is often tinned for tank and radiator construction. Zinc plating is one of the acceptable protective coatings for steel. Lead plates are used in battery construction. Nickel has uses similar to Monel metal. Silver solder is a preferred method of pipe line assembling. Many of the copper alloys not specifically mentioned find occasional aeronautical use.

It is believed that the foregoing necessarily brief exposition of the uses of the heavier non-ferrous metals and alloys in airplane design and construction will show that despite their apparently great handicap in weight, these materials are well holding their own. It is believed that this is doubly creditable, when full cognizance of the airplane designer's desire to save weight and even more weight at all times, is taken into account, for in overcoming such "heavy" odds, these materials demonstrate that they possess other unusual features, not characteristic of alloy steel and the lighter metals. Close cooperation in design, and in the use of combination materials in the design of parts, have played a fair share in making these highly desirable properties available at a not too great cost in weight.

Welding Aluminum Castings

In welding aluminum castings, it is usually recommended that the piece be carefully supported in the preheating furnace and preheated very slowly preparatory to the actual welding. Experienced aluminum welders, however, frequently dispense with the usual preheating furnace and handle even complicated jobs entirely with local preheating, using an oil burner for the purpose. The technique employed in this method is most interesting.

The illustration shows a welder at work on an aluminum casting 56-in. in diameter and ¾-in. thick, the lid of a

Welding an Aluminum Casting

rotary bottling machine, cracked from one edge about 20-in. toward the center. The circular shape of the casting made the expansion problem fairly easy, although it was complicated somewhat by a manhole opening at one edge through which the crack passed, and by the fact that when the reinforcing ribs passed through the center bearing, the metal was considerably heavier than elsewhere.

The lid had a crown of about 3-in. which increased the difficulty of penetrating the full thickness without forming projections of metal on the inside. This was to be avoided as it would necessitate extensive finishing. Although preheating the entire casting in a furnace was unnecessary, it would be desirable to heat it locally along the crack, just ahead of the welding flame, so the welding heat would not bring on too sudden a rise in temperature and cause further cracking.

Briefly the procedure was as follows: a steel plate was formed to fit the inside of the lid, and clamped to it along the crack. Then the whole casting was fastened to a flat surface and the two sides of the break were aligned at the open end by a steel strap clamped in position. Then the opening was veed carefully.

First the whole length of the break was heated slightly with an oil burner. Welding was then started at the inner end of the break, with the preheater heating the aluminum thoroughly a few inches ahead. To insure a sound weld, both a puddling rod and cast aluminum flux were used. The puddling rod is used to remove oxide from the surface of the molten weld metal. As work progressed the preheater was still kept playing along the break, always a little ahead of the welding flame. This opened the crack up to the limit of expansion. As sections of the break were finished a covering of asbestos paper was put on, and all during the work great care was taken to keep drafts and cool air from the work.

With these precautions the welding went ahead quite smoothly, in fact, the whole break 40-in. long was completed in about an hour and a half.

Bright Annealing Copper

The bright annealing of copper is an industrial practice of considerable importance. In connection with this process, equilibrium concentrations of carbon monoxide and dioxide, which may exist in contact with copper and cuprous oxide at elevated temperatures, are of interest. Data obtained at the Pacific Experiment Station of the United States Bureau of Mines, Department of Commerce, Berkeley, Calif., in co-operation with the University of California, enable estimates of these equilibrium concentrations to be made in two independent ways.

Although the publication of final data on one method can not take place until certain further experimental work is accomplished, repeated requests which the Bureau of Mines has had for data relative to the annealing and deoxidation of copper have brought about the issuance of a preliminary report, Serial 2926, "The Reduction of Cuprous Oxide by Carbon Monoxide," by Chas. G. Maier. This paper deals with the calculations of gas concentrations in the reduction of cuprous oxide, using more scientific data which will be published later, and refers especially to those conditions of temperature and concentration of practical implication, and from which critical limits ensue.

The limits which must obtain technically in the bright annealing of copper when carbon monoxide is the reducer are defined in this paper. The possibility of the use of a carbon dioxide atmosphere containing small amounts of carbon monoxide for the deoxidation of copper both in the solid and liquid state is also suggested.

Copies of Serial 2926 may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

A Brass Foundryman's Progress

How a Boy Grew Up to Be a Brass Foundryman. His Adventures, Joys and Sorrows, as Told to William J. Reardon.—Part 1.

By OTTO GERLINE
Gerline Brass Foundry Company, Kalamazoo, Mich.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

DEAR BILLY: Some time ago you told me that the history of my life from the time I was left an orphan was so interesting that I ought to write it as it might be interesting reading for a great number of people; and it may be for the good of some of our younger boys to learn what I had to go through to make an honest living. You also said it may help some of our young men in the brass foundry business; I sometimes believe that it would do some good. But, you also know that I was compelled to leave school at eleven years of age and that my education was "slightly" neglected, especially the literary end of it. If I could make myself believe that people would believe that I am telling them a true story and would excuse my grammar I would be tempted to follow your advice.

My sole inheritance from my parents was what few clothes I had and a little bad temper from my dad; and I also believe a few good points from my mother. I will not say anything about my life before my mother died, because I have reasons for not doing so that will appeal to any fair-minded man or woman. I had a sweet little mother, one of the best that ever lived. My father was a quick-tempered man and mother suffered much, and—I wish to spare my father. The marriage was not a happy one and I will let it go at that. From then on I will tell the story as well as I can remember it. Exact dates you cannot expect, and I will not even try to give them.

I will tell the things as they happened to me and things that I did—whether they were wise or foolish. I guarantee you that some of them were comical. I had a number of jobs before I really got started in the brass foundry game and I believe you will enjoy reading them, so I will give them to you in jobs. None of them lasted long; I learned about twenty trades and a few professions in less than a year. I believe it will make some good reading. You told me once that if I could write these things as well as I could tell them before the Volstead Act went into effect I would make a fortune. I don't want a fortune, Billy—they are too much trouble, with their income tax, inheritance tax, donations, wild parties—to say nothing of wild women. All I want is a nice, clean, honest business, credit everywhere, a little money laid away for a rainy day, a nice good wife, two nice sons who are a credit to their parents and who can run my business as well as I can—or better, a nice daughter-in-law and a lovely grandchild—and a reputation for honesty. I thank God I have got all these and often think it is more than I deserve. Of course, I have my faults—Billy, you know that—and as Mark Twain once remarked: "There are fifty-six faults in this world—I have got fifty-five of them." I don't know what the other one is; I may have the figures wrong, but you know what I mean.

I will give these experiences in jobs, with apologies to Bruce Reynolds who wrote the wonderful book on cocktails, "in sips."

An Orphan at 12—and Broke

As I told you before, after Mother died my finances were very low. I tried to float a bond issue at 4%—nobody wanted them. I tried it at 6%, 8%, and I even went as high as call money in Wall Street lately. I was not a success; it didn't work, and so I made up my mind that in order to stay out of that orphanage into which my dear relatives tried so hard to put me I must get a job. After peddling handbills for the McNish Johnson and Slavins Minstrels, all day, I got fifty cents in good hard cash and a ticket for nigger-heaven, as we called the gallery. I ate a good supper, spent twenty-five cents for it, and slept in a P. R. R. box car that night and had twenty-five cents left for the next day. I had two thicknesses of newspapers for a mattress and springs and while it was not the softest bed in the world I am sure it had no bedbugs in it.

A "Combination Store" Job

Next day I struck a job in a combination store. It may be that Sears, Roebuck & Company got their idea from this store and called it a department store. This store was also a department store—it was composed of a grocery department, meat department, barber shop, and saloon with a slaughter-house and sausage kitchen in the rear. I was to get my board, fifty dollars at the end of the year and a pair of boots. They did not tell me at once whether I was hired as general manager of all departments or just a single department. As it turned out, I went through all four departments—and in a hurry; I was graduated one day unexpectedly with the assistance of the 220 pound proprietor. I ate what I could get hold of for the next week or so standing up, but I was a graduate. I was a full-fledged barber, grocer, butcher and bartender.

As nearly as I can remember, this is how it happened. The man took me to his home and showed me where I was to sleep. It was up in the garret—a cot to sleep on and a lot of nails driven in the rafters to hang my spare clothes on. I didn't need the nails because I had all my clothes on my body, and these I hung on the floor sometimes, but slept in them most of the time because I was too tired to take them off when I had time to go to bed. At times my boots were so wet that I could not get them off, so I turned in—boots, clothes, and all. However, I am going too fast, I am going to bed before I did a day's work. So I ask you to please forgive me for this error and I will try to tell what my day's work was for a boy not quite twelve years old.

Cleaning the Store

The butcher called me about 4:00 A.M., took me out to the stable and showed me how to clean a stable and how to curry a horse—we had two of them. He next showed me how to water and give the horses their breakfast. Well, I started to curry this horse and all went along well until I got to the horse's hind legs and commenced to curry his

knees or whatever you call them on a horse—I don't know to this day. It seems the horse didn't like it, or maybe he was ticklish or I pressed too hard, or something went wrong; anyway, I found myself out in the alley with the back door of the old barn on top of me. I couldn't holler foul because he had hit me or kicked me low and knocked all the wind out of me and there is where I took my first drink of whiskey. When I came to, the butcher made me drink out of a bottle and said, "Take a drink of this and you will be O.K. in a few minutes." I took it and gave it right back to him in his face and all over him. Can you imagine that? Let that fellow give me that bottle now and see what will happen to it! He let me sit down for a little while then and he curried the horse and told me to watch him closely and I did. He started, all the time talking to the horse as if the horse could understand him, saying, "Whoa, Billy, whoa, Bill, you old rascal, don't kick me or I'll knock your brains out," and so on, but Bill didn't seem to like to be tickled by him either and swung at him (Bill Evans would have called it a strike). He missed him a mile. How I have wished since that that horse's name was Babe Ruth instead of Bill, and how I wished it would have happened in St. Louis instead of Erie, Pennsylvania. Well, that guy kicked that horse until I told him not to do that as the horse had made a base hit when I pitched to him and I didn't kick him for doing it. Maybe it was because I couldn't. Anyway the big stiff was mad and slapped me in the mouth for my trouble. The next on the program was greasing the buggy and a light wagon.

Then, we went down to the combination store, I swept out the barber shop, grocery department, meat department, scraped the blocks, washed out the icebox and filled it with ice. He looked over the meat and some he threw in one basket to be used for sausage, and some he threw in a brine barrel to be sold as corned beef later on, personally if I had to do it now, and as I remember it, I would have thrown it all in a garbage can. The next move by our department—or we, I mean the butcher and myself—was to the saloon. Here Fritz, as we will call him hereafter, took about three good drinks of whiskey and washed it down with a glass of Nightwatchman, as he called the beer left in the keg overnight. He remembered what I did with the other whiskey so he didn't offer me any. He had me empty all the spittoons or cuspidors, sweep up the old sawdust and put new sawdust on the floor while he washed some glasses and took a few more drinks. About this time my stomach commenced to ask for its breakfast; Fritz told me we would have breakfast about nine o'clock. If ever you got up at 4:00 A. M. and waited until 9:00 A. M. without breakfast you will understand what I am trying to tell you, especially if you were a good, healthy kid. About this time the barber came to work, an important sport with a big mustache, just over from Germany a few months. As he was a corporal in the Kaiser's army at one time, he at once commenced finding fault with our work, and of course, blamed everything on to me.

Next came the boss's oldest daughter, the grocery clerk; she also took care of the meat department. She was a nice girl, said I was a nice boy and said she hoped I would like my job and stay with them. I was going to thank her, but the same thing happened to me as when the horse kicked me. I was out of wind and all I could do was to turn red to the ears and get that burning feeling all over my face.

Next came his Majesty, the Prince of Pilsen or Pilsner, the bartender, with a mustache larger and more curly than the barber's. He looked at Fritz, then looked at the bottles and some kind of an argument started about drinking out of a certain bottle. When the argument was over (which was held in German) they both took a drink out of the same bottle and then the Prince turned to me and said, "Halts, maul," or shut up, and I hadn't said a word. Neither did I say anything afterwards. Anton was also out of the Kaiser's army, but only a buck private.

Delivering Orders

All the dirty work done, we washed and got ready for breakfast; the combination store was ready for business; and believe it or not, some men at the Battle Creek Sanitarium would give one million in General Motors stock if they could eat a breakfast like I ate that morning. After breakfast to the department store again, and now for the real job. With a boy's express wagon I delivered the groceries and meat. I liked that much better, because I could swipe a few ginger snaps and cookies and once in a while a piece of candy. The girl caught me at it and I blushed again, "but"—and all she did was to ask me if I liked that kind of stuff and I told her I did. She asked me if ever I got any at home, and I told her I had no home; then she asked me a lot more things and she said, "You poor boy." Her and I got along real good, and I've been getting along good with the girls ever since.

The last delivery I made that morning was a sack of flour; it fitted nicely in my little express wagon, and was to be delivered to a family that lived below the hill. From the top of the hill to the house was a nice street, and I got on top of my flour sack and little wagon and started coasting down hill. Everything went O. K. for a while, until I got near the bottom, where a dog came out of a house and, thinking I had lots of fun, started after me, and then it happened the dog, the flour, the wagon and myself landed in a ditch. The dog was a black dog, when he came out of the house, but he was a different looking dog when he went in: he was a white dog with black spots around his eyes and his tail was black; the flour wouldn't stick to the tail. He was a funny looking dog. How I looked with the balance of the flour on me I leave to your imagination. With all the flour gone and one wheel broken on my express wagon I was in considerable trouble. The lady I was to deliver the flour to was the mother of a boy friend of mine, so with tears streaming down my cheeks I went to her house and told her all about it. She went back to the store with me—and anyway they didn't hang me, but the boss said he would charge the whole thing up to the fifty dollars I was to get at the end of the year. That was O. K. with me, as I had a kind of feeling that I wouldn't last a year in the place. (I lasted less than a month.) I had to carry the sack of flour to the lady's house; I then went to a junk shop to get a wheel for my express wagon. This wheel was not the same size as the others, and my express didn't run quite as well, but I made it go.

Turning Butcher

Dinner, I believe, came next. After dinner Fritz showed me how to trim bones, that is cutting the bones and gristle out of meat to go into sausage. The second cut I made took part of my little finger off and I had a hunch right there that the only trimming to do with bones and at the same time keep my fingers was in a crap game. After the finger was bandaged up, they figured that a better job for me would be to clean the slaughter-house and sausage kitchen, located directly behind the department store. I believe that I did a fairly good job on this and I also believe that the sausage cooking kettle got the surprise of its life; it got cleaned for once anyway.

Supper came next. After supper I made the beds and did the chamber work for the horses. Back to the sausage kitchen, clean casings for bologna sausage, liverwurst, head cheese or what have you. This is a very sweet, clean job, and when you get through, nobody with any sense

would take you for Mary Garden perfume or Djer Kiss—believe it or not. About eleven P. M. to bed, and I want the whole world to know that I will give a thousand dollars to anyone today that could give me one week, seven nights' sleep like that. I went to bed—clothes, boots, dirt and all. My mother always made me say a prayer before I went to sleep, and I have the habit yet. On this particular evening I got as far as "Now I lay me down to"—and I was asleep.

Bringing the Heifer Home

Next morning at four A. M.—up again. This day Fritz and I drove fourteen miles out in the country, where the boss had purchased a heifer. Fritz put a rope around the heifer's neck and told me to bring it home. He drove away to purchase some lambs or something and left me and the heifer to get along the best we could. Every farm we came to this heifer wanted to make a social call, and I pulled on that rope until my hands were blistered. About this time I got a bright idea: I tied the rope around my body and whenever the heifer got too frisky I would lean backwards and put my weight and strength against her's. This worked fine until about within four miles of the city; a dog came out of a farm yard and started for the heifer. The heifer turned on the gas, shifted into second, then high and stepped on the gas. I kept up for about fifteen feet and then I played tail light or exhaust to this lady for about a half mile, through muddy water puddles and sand burrs. When I finally got up on my feet again I was a different looking boy: my clothes were torn, my hands and face were bleeding, and I spit out more or less good, valuable soil. I looked myself all over to make sure I was in one piece and not cut in two, where the rope was tied. I was all together—but how!

Selling Meat

My next experience in the butcher department was somewhat different. By this time I could help to wait on customers in the meat department; here I did well. If a lady wanted a pound of steak or sausage, I would put it on the scales, and if it happened to be one pound, two ounces, three ounces, or five ounces I let her have it for one pound for the simple reason that I could not figure how much more three ounces at seventeen cents per pound would amount to. Pounds and half-pounds I could get away with, but ounces bothered me—so I gave them the best of it. I made a lot of friends in this way, and everybody told the boss what a nice, good boy he had in his department. He finally got onto my wonderful success with the customers, and what he told me would not make refined reading—so I will say nothing about that. I cried a little and told him I would do better. The next day a lady came in for two pounds of frankfurters, I put a bunch of them on the scale and they weighed too much; I took one off and they didn't weigh enough, so I cut one in two and it was still heavy; I cut it in two again. The lady asked me what I was doing, and I told her that the boss told me to give the customers correct weight and that was what I was doing. She didn't like the idea and told the boss. He came over, told me to get on the other side of the store, took two more frankfurters, put them on the scale with the others and wrapped them up for the lady. She smiled as he made excuses for my ignorance, and everyone was happy but me. I knew something was coming to me. This was about all the butcher department experience I got. I may remind you here that there were no computing scales at that time.

Turning Barber

Before I go into the barber department I will let you know that the lady clerk had a sister about my age; I used to go to school with her. I fell in love with her, and every time I met her I didn't know whether I was coming or going. One Saturday morning the boss told me to clean up extra good, shine my shoes and dress up in my best pants and put on a clean shirt—he was going to put me in the barber shop to help Anton. I fixed up as per command, and Anton gave me a white coat to wear and showed me how to lather a man's face. We had two chairs—and one barber. The idea was: I would lather a man's face and get him ready and he would perform the operation. I would then comb the man's hair, finish him up and call for the next victim. I practiced on Fritz and several good customers, who were willing to help a kid along. By supper time I was doing real well and outside of pouring the water or hair tonic down a man's neck, filling his ears with face powder and perhaps shove the lather brush in his eye, I was fast learning the barber trade. Anton, of course, had a whole lot to say all the time, but he was a little good-natured about it and I was a happy kid as I went home to supper.

The barber shop closed at nine P. M. My little girl told me she would come down to the store after supper and maybe she would walk home with me. This was my ruination and cut short my barber experience, and the world lost a good barber. She said she would walk by the shop window when she came down, and promptly at eight o'clock I started to look out of the window, and not at the customer's face. I dropped the lather in their eyes, their ears and anywhere it did not belong. Just as I was performing along these lines she came along, curls and all—my goddess. She smiled and I grinned and turned red all over, and as the customer opened his mouth to object I shoved the same instrument in his mouth. Of course he got up and spit and cursed. Anton turned around, took in the situation and took me by the neck, turned me around and made a place kick that was perfect. I picked myself up and there stood the boss and he with his number ten boot and his 220 pounds kicked goal.

This history will be continued in an early issue.—Ed.

Electrodeposition of Copper

An Historical Note*

By F. A. J. FitzGerald.

In order to incorporate changes in maps that have been engraved on copper plates. Wheatstone suggested that instead of hammering up and filing away the section to be changed it should be filled up with an electrically conducting material ready for the new engraving. The copper deposited, however, turned out to be too brittle to stand the pressure of the printing process. William Dalgleish overcame this brittleness by placing a plate of smooth copper horizontally on the bottom of the electrotyping dish, and suspending over it at a short distance the plate of copper to be deposited on. With the aid of a mechanical device, he kept the dish rocking and therefore the electrolyte always in motion. The deposited copper was found to be hard, elastic, and much more homogeneous than that deposited when the liquid was at rest. It stripped off the matrix satisfactorily. It was found that the speed of the movement of the liquid was the important factor in the deposition of the copper. These experiments resulted in large-scale equipment, which was used by the government in Ireland for more than twenty years.

* Abstract of a paper read before the American Electrochemical Society, May 27-30, 1929.

Testing Materials Society Meeting

A Report of the Thirty-Second Annual Meeting of the American Society for Testing Materials in Atlantic City, N. J., June 24-28

THE American Society for Testing Materials met at Chalfonte-Haddon Hall, Atlantic City, N. J., June 24-28, 1929. Fourteen sessions were held, covering papers and committee reports.

Those relating to non-ferrous metals are given below:

EDGAR MARBURG LECTURE AND AWARD OF CHARLES B. DUDLEY MEDAL

Fourth Edgar Marburg Lecture: "The Nature of Cohesive Forces in Solids," by Dr. Saul Dushman.

The Edgar Marburg Lecture was established in 1926 for the purpose of having described before the Society by leaders in their respective professions outstanding developments in the promotion of knowledge of engineering materials. Dr. Edgar Marburg, after whom the Lecture is named, was secretary-treasurer of the Society from its incorporation in 1902 until his death in 1918.

Dr. Saul Dushman, the fourth Edgar Marburg lecturer, is assistant director of the research laboratory of the General Electric Company, at Schenectady.

Charles B. Dudley Medal: Award to J. J. Kanter and L. W. Spring.

The Third Award of the Charles B. Dudley Medal will be made to J. J. Kanter and L. W. Spring, joint authors of the paper entitled, "'Long-Time' or 'Flow' Tests of Carbon Steels at Various Temperatures with Particular Reference to Stresses Below the Proportional Limit," presented at the annual meeting of the Society in 1928.

CORROSION AND FATIGUE OF METALS

Method of Making Copper Replicas of Corroded Metal Objects. E. S. Taylerson.

A description of an application of electrotyping to corrosion work. Copper replicas in relief of corroded rivets are taken at intervals to enable accurate estimates to be made of progressive corrosion.

Report of Sectional Committee: On Zinc Coating of Iron and Steel. J. A. Capp, chairman.

Report of Committee D-14: On Screen Wire Cloth. R. W. Woodward, chairman.

Status of long-time exposure tests being conducted on representative non-ferrous screen wire materials. Recommendations for adoption as standard the specifications for non-ferrous insect screen cloth.

Report of Committee B-3: On Corrosion of Non-Ferrous Metals and Alloys. T. S. Fuller, chairman.

Progress in outdoor exposure tests, in erection of racks, procurement of materials and development of further details of tests.

Corrosion of Metals Under Stress. D. J. McAdam, Jr.

The influence of stress, time, and number of cycles on the penetration of metals under corrosion. Cycle frequencies ranging from one cycle per hour to at least 6000 cycles per minute are considered. The materials investigated include carbon and ordinary alloy steels, corrosion-resisting steels, monel metal, and aluminum alloys. Practical application to service conditions is also discussed.

NON-FERROUS METALS, GENERAL

Report of Committee B-1: On Copper Wire. J. A. Capp, chairman.

Tentative specifications for bronze trolley wire. Reports progress in the study of specifications for wire and cable for transmission lines, and cooperation with the National Electrical Manufacturers Association and the American Mining Congress in the development of standards for grooved trolley wire for mine service.

Report of Committee B-2: On Non-Ferrous Metals and Alloys. William Campbell, chairman.

Progress in the extensive investigation on die-cast metals and alloys and completion of arrangements for corrosion tests of die-cast alloys at nine locations. Cooperative analytical work on the methods of analysis for silver solders and zinc-base die-casting alloys.

Aluminum Alloys for Pressure Die Castings. Sam Tour.

Requirements which aluminum-base alloys must meet in order to be suitable in the pressure die-casting process and the effect of various impurities in the alloys.

Report of Committee B-7: On Light Metals and Alloys, Cast and Wrought. J. B. Johnson, chairman.

Organization of new committee. Recommendation for adoption as standard with a few minor revisions the specifications for aluminum ingot for remelting, and for aluminum sheet. Revisions, by the addition of a number of new compositions, of the tentative specifications for aluminum-base sand casting alloys in ingot form and for aluminum-base alloy sand castings. Organization of new sub-committee on magnesium-base alloys and progress in the study of specifications for magnesium base casting alloys.

The Effect of Corrosion Accompanied by Stress, on the Tensile Properties of Sheet Duralumin. H. S. Rawdon.

The high-strength aluminum alloy commonly known as "duralumin," an important material in aircraft construction, has been found to become quite weak and brittle occasionally while in service. As a result of a rather extensive study carried out at the U. S. Bureau of Standards in cooperation with various government agencies interested in aircraft, the reasons for this undesirable behavior have been greatly clarified.

As a part of this study, the effect upon the tensile properties of sheet duralumin of subjecting the material simultaneously to corrosive influences and to stress has received considerable attention. Full-size tension specimens were corroded in a sodium-chloride solution containing hydrogen peroxide, by an alternate immersion method while stressed in static tension somewhat below the yield point or while being repeatedly bent back and forth in flexure. The tensile

properties of the specimens after corrosion were then determined.

The effect upon the tensile properties of corrosion under these conditions is summarized in graphical form. The corrosive attack on plain duralumin sheet was found to be increased by static tension, although the increase over the attack on comparison unstressed material was not great. The attack on aluminum-coated duralumin sheet was found to be entirely negligible even with severely corrosive conditions accompanied by relatively high tensile stress.

Corrosion accompanied by repeated bending stresses was found to constitute a very searching test for corrodibility. Even here, however, the aluminum-coated duralumin is so decidedly better in its behavior to the plain duralumin as to leave no uncertainty whatever as to the superiority of this type of material for purposes where high strength, lightness and corrosion-resistance are conditions to be fulfilled.

Fatigue Resistance of Some Aluminum Alloys. By J. B. Johnson and T. T. Oberg.

This paper is presented as additional data on the endurance properties of aluminum alloys. Several investigators have presented such data, but a noticeable discrepancy exists in the results as reported. The endurance or fatigue limit has been assumed on the basis of about 300,000,000 cycles. The results reported in this paper indicate that 500,000,000 cycles are insufficient to determine the endurance limit. An endurance limit at 300,000,000 cycles is satisfactory for most practical purposes, but with modern aircraft equipment a propeller may be subjected to over one billion alternations of stress in a year's service. The results of this investigation have led to a reduction in the allowable stresses used in the design of aircraft propellers.

NON-FERROUS METALS: COPPER AND COPPER ALLOYS, METALLOGRAPHY

Report of Committee E-4: On Metallography. H. C. Boynton, chairman.

Recommends for advancement to standard the recommended practice for radiographic testing of metal castings. Submits list of institutions and companies now equipped with apparatus for X-ray examination of metals. Presents standard micrographs for comparison of grain sizes.

Report of Committee B-5: On Copper and Copper Alloys. Cast and Wrought. C. H. Mathewson, chairman.

Outlines organization of new committee in the non-ferrous group consisting of the members of former sub-committees II and III of Committee B-2 to have complete jurisdiction over copper and copper-alloy standards. Recommends for advancement to standard tentative revisions of five existing standards.

Physical Properties and Methods of Test for Some Sheet Non-Ferrous Metals. J. R. Townsend, W. A. Straw and C. H. Davis.

This paper continues an investigation undertaken to secure a simple and reliable method of test for sheet non-ferrous metals and the development of commercial test limits. A previous paper presented data to show that the Rockwell hardness tester was the most suitable instrument for preliminary inspection purposes. Commercial hardness limits have been developed based on a Rockewll hardness-tensile strength relationship that has been determined for each alloy. In practice the Rockwell hardness limits are applied, but if the results are near to or outside the limits a tension test is made.

The Rockwell hardness and tensile strength limits are given for four alloys of brass, and two alloys each of nickel silver and phosphor bronze. The physical properties of the rolling series upon which these limits were based are presented as well as experience data obtained on shipments of commercial material. The limits for brass alloys A, B and E are considered final, but the limits for the other materials are tentative until more complete experience is available.

Grain size limits are given for annealed brass, nickel-silver and phosphor-bronze sheet. The grain count is made by comparison with the standard photomicrographs reproduced in the 1929 report of Committee E-4 on Metallography.

Refinements in the calibration of the Rockwell tester by using standard test blocks are given, as well as further development of testing technique. An experimental model of a motor-driven bend test machine is described.

Fatigue Studies of Non-Ferrous Sheet Metals. John R. Townsend and Charles H. Greenall.

The paper describes the development of a fatigue test machine for sheet metals and gives results of fatigue tests on five alloys of alpha brass, one alloy of nickel silver, one alloy of phosphor bronze and Everdur.

The results indicate that cold work raises the endurance limit but not proportionally to the increase in tensile strength produced by the same cause.

Micrographs are shown indicating that fatigue failure of the metals investigated is transcrystallin.

Dispersion hardening of alpha brass by nickel silicide increases the endurance limit.

The ratio of endurance limit to tensile strength of these alloys varies from 0.12 to 0.36, depending upon the composition, heat treatment, and cold work. These ratios are much lower than similar ratios for steel.

Hardness Relationships and Physical Properties of Some Copper Alloys. C. H. Davis and E. I. Munson.

The hardness relationships of several commercial copper-zinc and copper-tin alloys, and three copper-nickel-zinc alloys have been studied. The evidence of tensile tests, and Brinell, Rockwell and scleroscope hardness values on annealing and rolling series has been assembled in tables of data and plotted in eleven charts.

The hardness-tensile strength relationship not only varies progressively with chemical composition, but is also dependent on the previous mechanical and thermal treatment to which any single alloy has been subjected. The hardness relationship (Brinell, Rockwell and scleroscope) are also determined by the governing conditions of composition and previous history of the material. This is likewise true of the tensile strength-elongation and hardness-elongation relationships.

A single line composite conversion chart is obviously liable to introduce considerable error, and the use of such curves should be discouraged.

An X-ray Study of Copper Which Showed Directional Properties on Cupping. By Arthur Phillips and Gerald Edmunds.

This paper reviews briefly the important literature dealing with the orientation characteristics of copper in the hard-rolled and annealed conditions. An X-ray study, by the monochromatic pinhole method, of an-

nealed copper which showed directional properties on cupping is described. Fiber photographs of rolled and annealed metal are given, together with analyses of the structures involved. It is suggested that pronounced directional properties may be eliminated by limiting the degree of cold working and avoiding excessively high annealing temperatures.

Bearing Bronzes With and Without Zinc. By H. J. French and E. M. Staples.

This paper describes the results of laboratory tests of bearing bronzes with the object of classifying the alloys in the copper corner of the copper-tin-lead system according to the character of service for which they seemed to be best adapted. The effect of 4 per cent of zinc on the properties of these bronzes is also discussed.

Bronzes with less than about 4 per cent of tin were considered to be unsuited for general bearing service but those low in tin and high in lead should serve satisfactorily for special requirements involving low loads.

Bronzes with less than about 5 per cent of lead appeared to be suited only for service where lubrication could be maintained; those containing more than about 5 per cent of lead were best able of any of the groups studied to operate for short periods in the absence of lubrication.

In general, the addition of 4 per cent of zinc to the copper-tin-lead alloys had a small influence upon the properties of the bronzes studied and with few exceptions such changes as were observed seemed to be beneficial rather than detrimental for bearing service.

Further development of test methods may show that zinc tends to increase the wear losses and duration of the "wearing-in" period of bronze bearings, but since this is also a function of the perfection of fit such effects would be disadvantageous only in certain cases.

The results seem to justify the conclusion that the effects of zinc up to 4 per cent are generally small and may be insignificant in comparison with changes in properties quite readily produced in bronzes from variations in foundry practice.

Protection from Chromic Acid Fumes

By DR. WILLIAM BLUM and J. J. BLOOMFIELD

Chief of the Division of Electrochemistry, Bureau of Standards, and Chemist, U. S. Public Health Service, Respectively.

FROM PUBLIC HEALTH SERVICE REPRINT NO. 1245.

DUE to the growth of chromium plating, a preliminary investigation was conducted into the methods of eliminating health hazards in chromium plating, by the U. S. Public Health Service, cooperating with the Bureau of Standards.

1. Natural ventilation is seldom, if ever, adequate to remove the chromic-acid spray produced during chromium plating.

2. Vertical ventilation, such as is commonly used in chemical hoods, is ineffective because it draws the chromic-acid spray past the face of the operator who is working over the tanks.

3. It is feasible by a properly designed system of transverse ventilation, with an adequate air velocity, to reduce the content of chromic acid to less than 1 milligram in 10 cubic meters of air.

4. Continuous daily exposure to concentrations of chromic acid greater than 1 milligram in 10 cubic meters is likely to cause definite injury to the nasal tissues of the operators.

5. The most efficient method of ventilation is to draw the air laterally across the top of the plating tanks into ducts from 1 to 2 in. wide and extending fully along one or more sides of the tank.

6. To be effective, the duct should not be required to draw the air a lateral distance of more than 18 in. For wider tanks there should be ducts on both sides, or else two ducts in the center.

7. The level of the plating solution should be at least 8 in. below the top of the tank and the duct should be at the top of the tank.

8. For effective ventilation it is necessary to have an air velocity at the duct of about 2,000 ft. per minute.

9. Care should be taken to avoid obstacles to the air current, such as large projecting anodes or racks.

10. A hood surrounding one or more sides of the tank may be advantageous in protecting against disturbance by other air currents, such as those from open windows or from other fans.

11. The operators should guard against injury to the nasal tissues by applying to them, several times daily, vaseline or mentholatum salve.

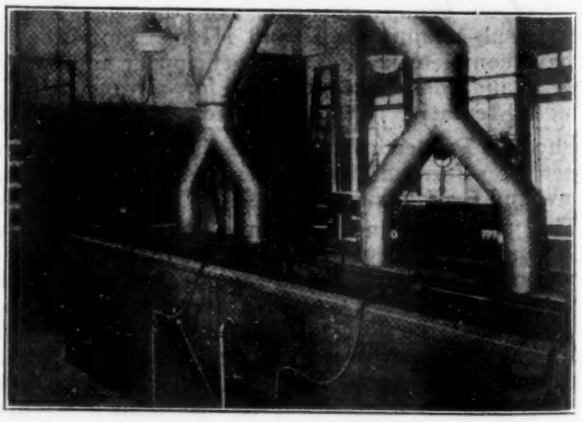
12. Rubber boots, gloves and aprons should be used when feasible, to prevent contact of chromic acid with any abraded skin.

13. If gloves are not used, the hands should be washed frequently with water, and all cuts or abrasions greased with a mixture of three parts vaseline and one part lanolin.

14. All floors near the plating tanks should be frequently washed down.

15. Operators should have periodic medical examinations, with prompt treatment of the slightest skin or nose affections.

16. Such treatment should include washing with bisulphite, ammonium polysulphide, or thiosulphate solution, application of an ointment, and a waterproof covering.



Chromium Tank Ventilation System

Die Casting Aids Mass Production

A Description of the Plant of the Stewart Die Casting Company, Chicago, Ill.

By J. B. NEALEY
American Gas Association

THE process of die casting consists of forcing molten metal into a permanent mould or die to solidify. The castings so produced are smooth, and, owing to the extensive core work possible, there is usually very little machining required. In fact intricate and extremely difficult castings can be produced at a considerable saving over the old methods, through this type of manufacture. The best results, so far, have been with the white metal family, namely, zinc, tin, lead and aluminum alloys. The die casting industry is expanding steadily.

One of the large die casting concerns is the Stewart Die Casting Corporation, a subsidiary of the Stewart-Warner Speedometer Corporation of Chicago, Illinois.

The Stewart Die Casting Corporation was organized primarily for die casting small parts for automobiles, but today it is producing castings weighing, in many cases, nearly 20 pounds and its activities embrace the making of castings for manufacturers of such articles as cooking utensils, washing machines, soda fountains, telephones, plumbing fixtures, motion picture machines, automobiles, tractors, and innumerable other units.

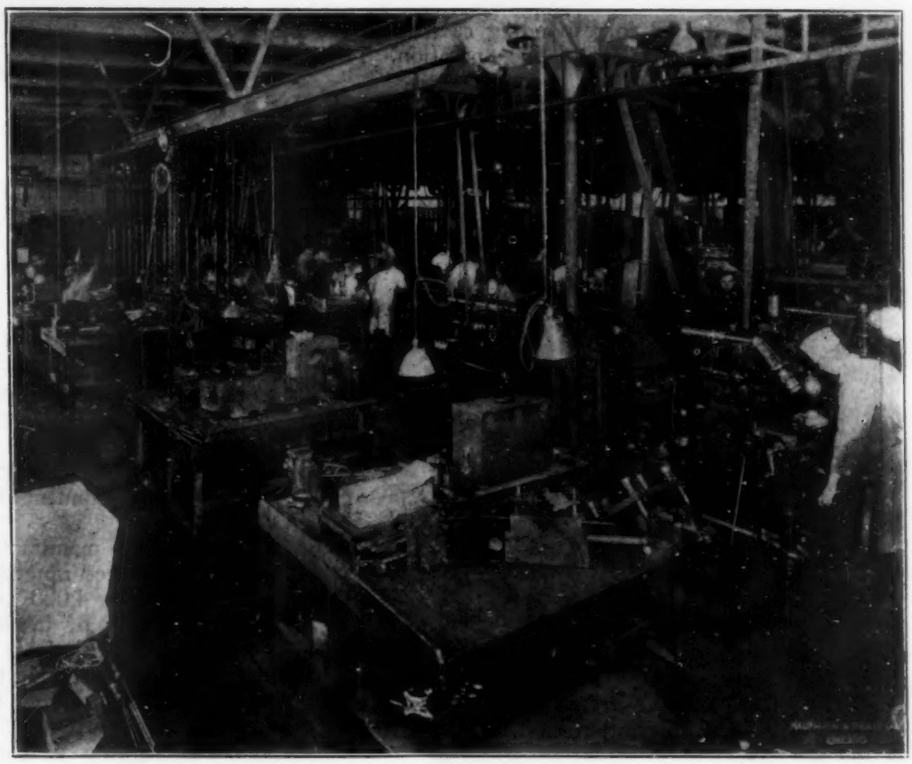
Practically every well known make of automobile uses die castings from this plant, such as vacuum tank parts, automatic lock parts, steering wheel spiders, bearings, control parts, switch levers, hub caps, etc.

The plant has approximately 180,000 square feet of floor space and each department is separately defined and under proper control. In addition to manufacturing die castings it also makes its own die casting machinery. The departments may be classified as follows: chemical laboratory for analysing raw materials; melting or alloying department; die casting department; cleaning department; tool room where die casting dies are made; heat treating where the dies and machine parts are heat treated, using gas as a fuel; machine shop where the die casting machines are built; storage room for the stocks of virgin metals and a receiving and shipping room which is served with a spur track from the Northwestern Railroad.

This corporation owes its success, among other reasons, to the accuracy of its product, quality of material, the small amount of machining necessary and its capacity for quick service. Special attention is given to the making of each individual casting, the alloys used being the most suitable for the requirements of each customer. Different types of machines are used for the production of the different classes of castings, that is, for zinc base, tin base, lead base or aluminum. All of these die casting machines are equipped with gas burners as gas has been found to be the most easily controlled, efficient and economical fuel.

A resume of the operations as performed in this plant is quite interesting and may be briefly detailed as follows: A large staff of engineers handles the laying out of the die casting dies from the customer's blueprints, while at the same time the chemical department makes studies to determine the most suitable alloy for the requirements specified.

The main die casting department is located in a room



Tool Room of the Stewart Die Casting Company, Chicago, Ill.

80 x 150 feet which contains over 100 die casting machines and 25 machines for making castings by the permanent mold method, this latter method consisting of hand pouring metal into steel dies. These machines are arranged in rows according to types and again into groups according to kind of alloy used. The controlling

Alloying Department

factors as to type include size, character and casting material.

Those castings of alloys with lead and tin bases require a machine of the plunger type in which a piston, actuated by air, forces the metal into the dies. There are others of the same general character, as these two types, with simple modifications. Melting pots or reservoirs from which the molten metal is supplied, are an integral part of these machines and all of them are heated with gas, fired from four to twelve burners each. The dies are water cooled.

The casting machines used in this plant were designed and are manufactured there under patents held by the company. Some castings made here contain as high as 12 cavities and the 12 corresponding cavities in the die are filled with molten metal in one operation. The pro-

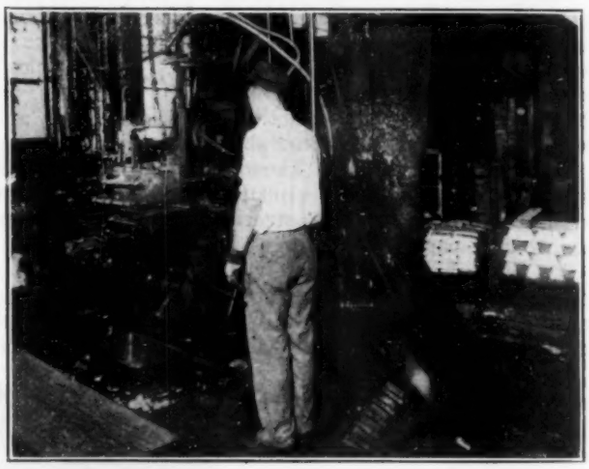
Removing Pigs from Molds

duction on a single type of small part, with multiple cavities, will run as high as 12,000 daily in some instances. At the other extreme are very large castings, with many inserts, the output of which will run as low as 250 per day.

Parts with as many as ten inserts are made here, an example being a certain type of magneto housing. This contains two laminated pole pieces consisting of a brass ring and copper tube each, and studs for the assembly which are set in the die and the alloy cast around them. A radio condenser, made here, consists of aluminum plates and a brass spindle. An automatic loading machine, developed by the company, sorts out the correct number of plates and inserts them into the die with the spindle and the metal is cast around them, thus combining an assembly job.

Loading machines for other castings will automatically count out the right number of inserts, and set them into fixtures, which in turn are set into the die by hand, ready for the molten metal.

This company carries from 1850 to 1900 dies some of which are active for six months at a time while others are changed at frequent intervals. These dies are kept in a storage room and issued as requisitioned by the foremen of the die casting department. The ingots are brought in to this latter department on skids, handled by lift trucks, and the castings are removed in tote boxes on hand trucks. Each die casting machine has a production schedule which is entered daily on a form containing all of the machines in the department. This form



One Type of Die-Casting Machine.

permits close control over the output of the plant as a whole, and each department individually.

The castings go direct from the die casting machines to the cleaning room which contains saws for cutting off gates, grinders, punch presses with trimming dies, lathes for trimming down cylindrical parts and drill presses with special fixtures for drilling and tapping holes too small for coring. In addition workmen at benches do hand filing on certain parts. There is also a battery of polishing machines and lathes where certain castings are polished preparatory to plating. Some of the presses are fed automatically.

There is a plating room completely furnished with standard equipment for nickel, copper and chromium plating.

The alloy manufacturing department contains 20 soft metal furnaces ranging in capacity from 100 pounds of aluminum to 4,000 pounds of lead per charge. These units consist of kettles set in brick foundations—each being fired with from two to ten gas burners. The gas is premixed with air in the correct proportion for complete combustion and forced through the burners at two pounds pressure.

The pigging of the alloys is a continuous operation

on a specified time schedule. This is made possible with the aid of continuous traveling slat type conveyors, the slats of which are replaced by cast iron molds, close together. These conveyors are located close to the furnaces and workmen ladle the molten metal direct from the kettles into the molds. The conveyors are suspended between two sprocket wheels, driven and idler, and are of sufficient length so that the pig is cool enough when it reaches the end to be handled. Here it is automatically dumped onto the floor or picked off and piled as the conveyor passes down under the nether side of the sprocket for its return travel. The pigs are then taken to the die casting room and fed into the die casting machines.

Machine Shop of the Stewart Die Casting Company, Chicago, Ill.

The tool room is supplied with the latest and most modern machinery for making and repairing dies. This includes lathes, milling machines, drill presses, grinders, planers, etc. The tool makers are the aristocrats of this plant because the value of the castings lies in the accuracy of the dies. They are also the highest paid men as the ordinary machinest is too crude for this fine work. An overhead monorail with chain hoists aids in the handling of the materials and machines.

A machine shop for the manufacture of the die casting machines used in the plant is maintained. This shop is completely equipped with the same type of machinery as that in the tool room except that in general it is much heavier. The general plant maintenance and millwright force also works out of this department.

The heat treating room is adjacent to the machine shop and here the tools, dies, trimming dies, machine parts, etc., etc., are treated. The equipment includes 14 gas fired furnaces of various types and sizes, together with cyanide, lead and salt baths, for all kinds of heat treatments. There is an overhead monorail with electric hoists for handling heavy parts.

Automatic pyrometer controls maintain the correct temperatures of some of these units while others are supplied with indicating pyrometers. In the office of the chief metallurgist is located a set of recording pyrometers by which he maintains a check on the work of the foremen in the heat treating department at all times. Some special processes of heat treating have been developed here including carefully worked out cycles and heats which are maintained with great care and accuracy. Scleroscopes and Brinell machines are used to check the degree of hardness produced in the different parts treated. Gas fuel is used throughout in this department.

There are many inspections and checks on accuracy of work throughout the plant which contribute to the high quality of product manufactured. A completely equipped chemical laboratory is maintained in which control over all raw materials and pigged alloys is obtained. These raw materials are purchased on rigid specifications and the alloys made up according to formulas carefully worked out at the plant.

Maintaining Nickel Solution

Q.—I am sending you a sample of a nickel solution which I have just begun to take care of. It is a good solution for certain kinds of work but I have no idea of its exact ingredients and in order to maintain the solution properly I need to know what it consists of. Could you analyze the sample and tell me what it contains and how to maintain its metal content, etc.?

A.—Analysis of nickel solution:

Metallic nickel	2.01 oz.
Chloride, as ammonium chloride	3.05 oz.
pH	5.6

Solution should be in good working condition, although the pH could be raised to 5.8. The chloride content is a little high, so do not add any more for some time to come.

The metal content can be maintained by making additions of nickel salts in the proportion of 2 parts of double nickel salts and 1 part of single salts when necessary.

—Oliver J. Sizelove.

Sherardizing

Sherardizing has, for a good many years past, established itself as one of the best methods known for the protection of iron and steel. It needs, on the part of those employing it, experience as well as a theoretical knowledge of the principles upon which it is based.

By A. P. PETRIE

SHERARDIZING is the name of a process of applying zinc to the surface of articles made of iron or steel in order that they may not rust. The name was coined from that of the man who discovered the process, Sherard Cowper-Coles.

The main principle remaining is that the work is heated in zinc dust.

Formation of Zinc Alloy

One particular reason why the name Sherardizing is so unfamiliar is that so very few articles which are so treated are advertised and sold as Sherardized. Either they are stated to be "rustless," "rustproof" or "treated by a special process to prevent rust" or else the fact is not mentioned at all. The process is quite distinct from most other methods of treating the surface of metal articles with a dissimilar metal in one important detail. This is that the zinc protection formed is actually an alloy of zinc with the surface of the article being treated.

The other methods, such as hot galvanizing, electrozincking, metal spraying, nickel or chromium plating, etc., of applying metal to the surface, result in coating the article with a skin or zinc, nickel, chromium etc., as the case may be. This skin may vary in thickness and may be very closely adhering, but it is still a skin or layer of metal on the surface.

Depth of Penetration

When Sherardizing is properly carried out, the base metal is impregnated with zinc which forms with it an alloy of progressive strength. From the deepest point of penetration, the zinc content increases rapidly as we near the surface, until we find, practically at the original surface of the base metal, an alloy consisting of 92 per cent zinc and 8 per cent iron (we exclude non-ferrous bases for the moment). It is upon this alloy that Sherardizing almost entirely depends for its efficiency. Beyond this point, there is formed a layer of almost pure zinc approximately .005 in. thick.

By increasing the time during which the articles being treated remain at the Sherardizing temperature in the zinc dust, an increased penetration of zinc, over and above the depth of about .002 in. usually obtained, takes place, but as a very much greater increase proportionately in the external layer of zinc is unavoidably coupled with this increase of time, it is a disadvantage to attempt it commercially, since the chief claim to commercial use of the process is the small dimensional increase combined with high efficiency as a rustproofing process. Nevertheless, it is necessary to build up a layer of zinc of at least .002 in. external to the base metal surface in all cases where it is specified that the work shall pass the copper sulphate immersion, or "Preece" test. It is necessary because in the test bright copper would be deposited, and therefore herald failure, on the stable alloy containing 8 per cent. of iron.

There is nothing to be gained, beyond slight extra resistance to mechanical abrasion, and much to be lost, by this increased external coating demanded by those who insist that this test be applied. It often occurs, therefore, that when nuts and bolts are specified to pass this test after Sherardizing there is difficulty in replacing the nuts on the bolts and the Sherardizing is blamed. Yet no better protection from corrosion is obtained by the addition of the extra zinc. It is also interesting to note at this point that galvanized bolts are accepted as having passed the test even though there is no zinc at all on the threads, which are obviously never tested. (N.B. The threads on galvanized bolts are nearly always cut after the galvanizing process is completed, otherwise the threads would be filled up with spelter and the nuts would not go on at all.)

Zinc dust, in which the work is heated, has one very peculiar property. This property is its catalytic action on water in splitting it into its two component gases. It is unfortunate that this property seems to remain with the solid zinc deposited by Sherardizing, and is generally considered, by those who have studied the point, to be the cause of the failure of Sherardizing as a protection when the work is immersed for quite short periods in "still water."

Limitations of the Process

Some considerable disappointment could have been avoided in the past if users of the process had understood this limitation. Sherardized surfaces which have withstood the corrosive atmospheres of the south Lancashire district for five years, have shown signs of rust when immersed in a bowl of water for about a fortnight.

The theory held by most of those closely connected with the process is that the Sherardized zinc splits the water into hydrogen and oxygen as does zinc dust. The hydrogen bubbles, being light, rise to the surface and burst. The oxygen combines with the zinc to form zinc oxide. The zinc oxide floats away in suspension in the water, and leaves fresh zinc exposed to the same action. Thus the cycle goes on and minute pinholes are formed in the surface until the base metal is reached at a point where iron oxide begins to form. This theory is supported by the appearance of the surface which becomes dotted with very minute spots of rust. In running water this does not happen, nor when exposed to ordinary atmospheric conditions, and it is thought that in such cases any oxygen bubbles which may be formed are immediately washed away before they can have any appreciable action on the zinc.

Whilst considering the limitations of Sherardizing it may be interesting to many to know that although Sherardized iron or steel is rapidly freed of its zinc protection when immersed in hydrochloric or sulphuric acids, such is not the case with Sherardized brass. Even a heavy coating of zinc on the surface of Sherardized brass is not affected appreciably by such acids.

Copper alloys required to resist acid solutions are composed of copper and tin, and zinc is rigidly excluded. In a zinc-copper alloy it is the zinc which is primarily attacked by the acid, leaving the metal spongy. It would therefore seem natural to assume that the greater the proportion of

zinc in such an alloy, the more rapidly destructive would be the attack of the acid. Yet, as proved by a long and thorough series of tests carried out some two years ago, the loss of weight in Sherardized brass lying in an acid bath is slightly less than the loss of weight in the same brass unsherardized in a bath of equal strength and at the same temperature.

For the purpose of the test and prior to it, the Sherardized test pieces were immersed for a period of two minutes in strong hydrochloric acid in order completely to remove the external zinc which was not alloyed with the brass. This first bath caused furious effervescence for a short period, after which no action remained visible, showing that no free zinc remained upon the zinc brass alloy. The differences in the losses of Sherardized and unsherardized brass is so slight as to be of no practical importance, and one does not recommend the Sherardized brass as a resistant to be used in continual contact with acid, but where brass is exposed to an occasional contact with acid or acid fumes, Sherardizing offers very distinct advantages. Unprotected brass under such conditions rapidly becomes coated with verdigris which seems to act both as a conductor and a retainer of acid, hastening the decomposition of the brass. On Sherardized brass verdigris is unknown. There is no means by which the acid may be retained indefinitely in contact with the metal, which is thus preserved, besides retaining a clean appearance.

Practical and Commercial Considerations

We now come to the practical and commercial considerations. Just as with other processes, so with Sherardizing, it is necessary to prepare the work by thorough cleaning, although, unlike electroytic processes, Sherardizing is not detrimentally affected by the presence of a little grease or oil of most types provided that the metal surface is free from rust and scale. The work is packed in containers with the zinc dust and heated in gas or electric furnaces, and the temperature, which does not exceed 750° F., is measured by pyrometers whose stems project into the centres of the containers. Although in theory there is no limit to the size of these containers, practically, it is not found to be advisable to exceed 24 in. diametrically, chiefly owing to the low heat conductivity of zinc dust and the consequent excessive heat liable to be generated at the periphery of the containers before the required temperature is reached at the centre. The limit of size longitudinally is only governed by purely mechanical considerations, and present day demands have resulted in the construction of containers 15 ft. 6 ins. long for the treatment of tubes for the electrical and other trades.

The porosity of the metal has no relation to the degree of penetration, and better Sherardizing is in fact obtained on a high grade carbon steel than on a low grade cast iron, simply because there is less impurity present. The greatest enemy of the Sherardizer is inrolled scale. Sherardizing will not bridge impurities, as will galvanizing, and it is essential in all cases that the surface presented to the zinc dust shall be only of metal. Remembering also that Sherardizing is an alloy depending for its success upon both the constituents of that alloy, it becomes obvious that the better the metal of the article treated, the higher resistance will Sherardizing offer to corrosion, and the better will be the appearance of the Sherardized surface.

Cost of Sherardizing

Such a treatise as this, which is written chiefly for those who have not yet experienced any of the innumerable benefits to be had from using the process on their productions or plant, would scarcely be complete without some reference to actual costs. The cost of Sherardizing is really a cost per cubit foot of space available in the containers, and if a container of say 5 cubic feet is filled with 5 cwts. of screws it will cost practically the same as if filled with say 1 cwt. of light gauge stampings. Therefore the price "per cwt." will be five times as much for the stampings as for the screws. In actual practice, however, it is often possible to fill up the space between the stampings with a few screws and so reduce all 'round costs, although this advantage is often nullified by the extra labor involved in sorting afterwards. Another point about the charge made for Sherardizing is that as far as prices per cwt. go, they are nearly always in inverse proportion to hot galvanizers' charges. Small screws, nuts, washers, etc., and small tubes can be Sherardized at prices well below those charged for hot galvanizing but, for large articles, particularly those made of sheet metal, the Sherardizing cost is too great to be a commercial consideration.

A few words on the subject of finishes. The natural Sherardized surface is a matt grey, but one or two methods of improving the appearance are available. A finish very suitable for small tools, such as motorists' tool kits, or for antique iron work, is obtained by scratch brushing after Sherardizing. A circular brush on a slow speed polishing spindle is used, the bristles of the brush being either steel or brass wire. The brass wire bristles give a pleasing brassy tint to the work. This process, by giving a semi-polish to the otherwise matt surface renders the work less liable to accumulate dirty finger marks or stains. The most attractive finish of all is generally considered to be the highly polished one obtained by polishing the work well before Sherardizing and then mopping it again after Sherardizing.

Polishing Not Advised for Sherardized Steel

Although the dull finish is an objection very frequently raised against Sherardizing, polishing is not to be recommended. The reason is that on a polishing mop revolving at about 2,500 revolutions per minute, it is very easy to wear away the whole of the protective surface, particularly on the corners, edges or raised portions of an article. If the surface is actually polished away on these parts it does not become evident until rusting occurs, since polished steel is almost identical in appearance with polished zinc. In this connection many people may have noticed that nickel-plated steel articles generally begin to rust in the first instance on the corners or edges.

Brass articles, however, can be safely polished after being Sherardized. They cannot naturally rust if over polished, but apart from that the zinc amalgamation with the brass extends to a much greater depth into the softer metal. The finish obtained on brass is difficult to distinguish from chromium plate.

Regulating Voltage at Plating Tanks

Q.—I have some brass goods which require a gun metal finish. I am using the solution made of sulphocyanide of potassium. I must use a very low voltage with this solution but I have other solutions which require 2 and 3 volts. How can I regulate my dynamo so that all the plating will be satisfactory? The dynamo gives me 6 volts, 250 amperes and 12 volts, 500 amperes.

A.—With a generator rated at 6 volts and 250 amperes you should be able to obtain at each tank any desired current density up to the capacity of the generator if you have proper tank rheostat control.

It is impossible to vary the voltage for different plating solutions by the use of the field rheostat, so we would advise the use of proper tank rheostats, which may be purchased from advertisers in BRASS WORLD.

—OLIVER J. SIZELOVE.

Electroplating with Cadmium

A Review of the United States Patents Relating to the Plating of Cadmium

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WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

THE properties of cadmium render it advantageous over other metals and alloys as a protective coating for metals such as iron and steel. It is light in color and has a higher solution potential than iron, thus tending to protect the iron from corrosion. The solution potential of cadmium is higher than that of iron and lower than that of zinc so that the same weight of protective coat of cadmium gives more protection against atmospheric corrosion than is given by straight zinc. More cadmium than zinc can be deposited per unit of current used. The coating of cadmium is thinner and more adherent than that formed on zinc. The tendency of cadmium to scale off and waste away is therefore much less pronounced than that of zinc.

An Early British Patent

The process of cadmium plating was first described in a British patent No. 12,526, granted in 1849 to Russell and Woolrich. It will be interesting to give a description of the process as it appears in this patent. "The first part of the invention consists of the application of cadmium and its alloys for coating the surfaces of iron and certain other metals and alloys of metals, either for the purpose of affording protection from decay or as a superior coating, and this metallic coating can be applied in several ways, one being by means of electric deposition, in the manner well known and practiced when depositing other metals. The mode we prefer for depositing this metal is to take cadmium and dissolve it in nitric acid of commerce diluted with about six times its bulk of water, and which water we prefer to be warm, about eighty degrees or one hundred degrees, adding the diluted acid by degrees till the cadmium is dissolved. To this solution of cadmium is added a solution of carbonate of soda, which is made by dissolving one pound of the ordinary crystals in one gallon of water, until the cadmium is precipitated, and the precipitate thus obtained is to be washed four or five times with tepid water. The precipitate is now fit for use, and various solvents for this compound of cadmium may be employed, but cyanide of potassium is preferred. We add as much of a solution of cyanide of potassium in water as will dissolve the precipitate of cadmium, and then add about one-tenth more of the solution of cyanide of potassium, so that it shall be in excess. The strength of this solution of cadmium may vary, but a solution containing six ounces of the metal to the gallon, is the solution we believe to be the best. The solution is now fit for use, and it is preferred to keep it warm while being used, about eighty degrees or one hundred and twenty degrees. The vessels employed are made by covering the outside of a strong wooden vat with sheet lead, in the manner the vats are made for holding solutions of silver for electroplaters, and in working we usually cause a plate of cadmium to be so placed in this vessel as to surround at the distance of a few inches the articles upon which it is wished to have a coating of cadmium. Should a galvanic battery be the source of the electric current, the wire from the zinc end is to be in contact with the goods to be coated, and the other wire with the plate of cadmium. The metal to be coated is first to be well cleaned, as heretofore practiced when intended to be coated with other metal. The plate of cadmium will generally require to be occasionally cleansed from any scurf which may get upon it, and which might otherwise interfere with the progress of the working. Cadmium may be used in solution with other metals, and be precipitated in combination, in which cases we either use plates of the alloy it is desired to have precipitated, or we use plates of the separate metals in connection, the solution being from time to time stirred. In depositing alloys of cadmium, we recommend that the cyanide of potassium should not be in any great excess, and generally we find that in such cases somewhat more power of electricity is desired than when using cadmium only; and in this case when we find in working either metal in excess, we substitute a plate of the metal which is deficient in the solution for the one which is in excess in the solution."

Rust Proof Piano Wire

The plating of cadmium has only been recently developed on a commercial scale. A recent U. S. patent 1,383,174 plates piano wire with cadmium in order to prevent rusting. The problem is discussed in this patent in the following language. Iron and steel structures are generally protected against the oxidizing action of the atmosphere by covering them with a film of a metal which is not readily attacked. Also non-metallic materials have been used for the same purpose. The first efforts to protect piano wire were therefore also to coat the wire with a suitable material. It was of course soon realized that out of the number of materials found available for protection of steel and iron in general only comparatively few could find practical application for the specific purpose, since the problem was not merely a coating problem pure and simple. It was soon found that all forms of coating were detrimental to the function of the wire as a sound producer, some more, others less. It was merely a question as to which coating has the least disturbing effect. Thus we find that gold, silver, copper, lead, nickel, tin, brass, cobalt, and a few other metals have almost exclusively been resorted to for the particular purpose. These metals have been applied in various ways and by various processes in unceasing efforts to make the film mechanically as perfect as possible and to reduce the injurious effect upon the tone quality, but as far as it is known these efforts have been more or less a failure.

Nickel, copper, silver and other non-rusting metals have a distinct tendency to hinder and deaden the vibrations of the wire to the extent of materially impairing its tone quality, no matter how evenly and perfectly the coating is applied. This defect is principally due to the fact that a film of these metals is inherently relatively thick and since the modulus of elasticity and other mechanical characteristics of these metals are materially different from those of the steel wire, the interference with the material function of the wire is considerable. To put some of these metals on a wire requires copper-plating first which renders it practically useless.

Another drawback found to militate against the successful use of these metals for coating is the fact that the coating almost invariably peels off. This is probably due to various causes including principally the difference in the mechanical and physical properties between them and

the steel wire, the insufficiently intimate union between the wire and the coating and perhaps the fact that these metals are themselves not absolutely immune against the action of the atmosphere. While it is not possible to assign with certainty the causes of the peeling off, it is probable that under the influence of the vibrations whereby the coating is alternately expanded and compressed the coating cracks or breaks and opens a path for the atmosphere to do its destructive work upon the wire and that the rust thus eats its way laterally of the cracks and destroys the union between the coating and the wire. As small and imperceptible as this initial process of rusting may be at first, it accentuates the crack, opening the way for the atmosphere a little further with the result that the portions of the coating adjacent to the crack are free and coil outwardly as is natural. The continuation of this process is the peeling off of the coating irregularly over the surface with the consequent destruction of the tone quality.

It has also been found that copper-plated wires not only deaden the tone as above pointed out, but also become covered with a green coating which is due to the action of the carbon dioxide in the air which formed copper carbonate and is necessarily injurious to the function of the wire.

The treatment of the wire may comprise the following steps:

1. Preparation of plating solution

A solution containing about 25 grams of cadmium per liter of solution is most convenient for the purpose. Enough of a salt of cadmium such as the sulfate or chloride to yield 25 grams of metallic cadmium is weighed and dissolved in as small amount of water as possible. If metallic cadmium is used, it may be dissolved in hydrochloric acid to form a neutral solution or it may be dissolved in nitric acid and evaporated to dryness with hydrochloric acid to remove the nitric acid. After the cadmium is dissolved and is in a neutral or nearly neutral solution, a solution of sodium or potassium hydroxide is slowly added until the cadmium is precipitated and the solution is red to phenolphthalein. Sodium or potassium cyanide is now slowly added until the precipitated cadmium oxide is all dissolved, an excess of cyanide being avoided. The solution is then diluted to one liter. The solution as thus prepared constitutes the bath used for electroplating the wire. Other strengths of solution may, of course, be used, but a solution of 25 grams cadmium per liter is found preferable for use. The anode is metallic cadmium. A current density of 7 amperes to 50 amperes per square foot of cathode area can be used. About 7 amperes per square foot are preferred. Lower and higher current densities have been used, and, in fact, the current density does not seem to affect the deposit. Only from 1-5 minutes are required and the average time of treating a wire is about 3 minutes. Deposits from this plating solution are very smooth.

2. Cleaning of wire

Before plating, the wire is cleaned of all rust and dirt by polishing with a very fine grade of emery cloth. If necessary, it may also be cleaned by dipping in dilute sulfuric acid or other chemical solutions and finally in water.

3. Electroplating

After the wire is cleaned, it is immediately electroplated. To do this, the wire is coiled into a small coil, and then placed in the cadmium bath and allowed to uncoil on the bottom of the bath to the sides of the vessel. One end of the wire is bent so as to project above the solution, to make connection with the circuit. The anode of cadmium is placed in a vertical position in the center of the coil and equally distant from all sides. It extends above the solution, to make connection with the circuit of a D. C. source. This wire, when polished, is satisfactory for the purpose, but is improved by the following heat treatment.

4. Heating

After the wire has received its coating, it is washed in water and placed in an oven and heated to about 150° C. to 200° C. The maximum in an ordinary oven is about 200° C. It has been practiced to hold the wire at about 185° C. for 3-4 hours. The time is not a very important factor, as good results were obtained by heating for 24 hours. Any reasonable length of time, from 2 to 24 hours, will serve the purpose well. The temperature should be such that there is only a slight coating of cadmium oxide formed on the wire. Excessive oxidation must be avoided. By burying the wire in calcium hydroxide, the temperature may be raised to about 250° C. without excessive oxidation. The degree of oxidation, of course, is governed by the temperature employed and the atmosphere in which the heating takes place. The heat treatment has the purpose to alloy the cadmium with the iron of the wire and also to harden the coating. It also serves the purpose of removing an excess of cadmium by burning it to oxide, if it happens that the coating is too thick. After the heat treatment the coating is very thin; this resistance is very important.

5. Polishing

After the wire is thus treated, it is buffed and polished. This removes the slight coating of cadmium oxide and leaves a bright polish on the surface. To give the wire a finishing touch and a very fine polish, it may be replaced in the electroplating bath to give it a very light additional deposit of cadmium. It is then washed in water and buffed to a very fine polish. Repeated coatings may be applied, but the treatment, as above described, has been completely satisfactory. This process has been applied to metal articles in general, such as springs and cutting instruments, for which patents have been granted.

The Use of Addition Agents

According to U. S. patent 1,536,858 it has been found that the use of addition agents very materially improves the character of the deposit, in that there is obtained a brighter, more dense cadmium surface, free from pores.

As an example of the method, a solution consisting of 1 gallon water; 0.415 pound sodium cyanide and 0.305 pound cadmium hydrate, is prepared to which is added a small amount of an addition agent, such as wool fibre. The quality of wool used is from 0.025% to 0.01% of the weight of the solution. The effect of this addition is to produce a uniformly bright, dense, even deposit of cadmium. The effect is enhanced by agitation of the solution during the electrodeposition, preferably by the use of compressed air.

It has been found that besides wool, there may be used as addition agents shellac, casein, licorice, glucose, and possibly other materials, the amount of each being exceedingly small. In the case of licorice and casein, 0.01% gives a fine result, none of the addition agents referred to need be used in amount over 0.05%. The brightening effect of these small quantities of addition agents lasts for a long time, but after several months' use of the plating bath, it is necessary to add some more of the brightening agent.

It is preferred to use a current density of about ½ ampere per square inch, or a little less. The bath is preferably maintained about 18° C. during the electrodeposition. The solution above described contains 2.5% cadmium per liter, but this degree of concentration may be widely varied as from 1.25% to 5%. Preferably the cadmium cyanide solution is kept neutral or basic.

The bright, dense cadmium coating, produced as above described, has been found to be particularly advantageous, when nickel is electrodeposited on the cadmium coated

article. It is found that the nickel coating can, without previous buffing of the cadmium undercoat, be buffed up to a high finish, and also that because of the dense, poreless character of this cadmium undercoat, the double-coated article is particularly resistent to rust.

Dry Plating Mixtures

The object of U. S. patent 1,564,414 is to provide a dry mixture of chemicals suitable for storage and shipment which, when dissolved in water, will give a cadmium plating bath. The following examples of bath compositions illustrate the invention:

Example 1. 3 oz. cadmium hydroxide; 6½ to 7 oz., sodium cyanide; ½ to 1 oz., caustic soda; ¼ to ½ oz., sodium carbonate, and 1 oz. aqua ammonia, 26° Be., to each gallon of water.

Example 2. 40 oz., cadmium hydroxide; 30 oz., ammonium sulfate; 85 oz., sodium cyanide; 13 oz., sodium hydroxide, and 9 oz., gulac to each 5 gallons of water.

A dry mixture, suitable for shipment, may be composed of for example cadmium hydroxide, ammonium sulfate, sodium cyanide, sodium hydroxide and gulac, or since the shipment of caustic soda and cyanide is somewhat objectionable, the electroplater may be supplied with a mixture of cadmium hydroxide, ammonium sulfate and gulac, with directions as to the quantity thereof to be dissolved in a given quantity of water along with caustic soda and sodium cyanide separately supplied. Or the electroplater may be supplied with a dry mixture of cadmium hydroxide, sodium hydroxide, sodium cyanide and gulac, to which ammonia or an ammonium salt is to be added in the preparation of the bath.

The electroplating from baths, comprising the combinations of chemicals described, may be carried out at room temperature, using a potential of 4 to 6 volts and a current density of 1 ampere per 100 square centimeters between electrodes, spaced about 15 centimeters apart, and preferably using cadmium anodes with an anode surface area equal to two or three times the cathode surface area. Known expedients, such as agitation or circulation or heating or cooling of the bath, rotation of the electrodes, etc., may be employed.

Plating Cadmium Alloys

According to the invention of U. S. patent 1,518,622, alloyed coatings are made comprising cadmium and another metal, such as cadmium and mercury or zinc, or zinc cadmium and mercury, using either plain anodes, with a suitable bath, or alloy anodes, or both. The coatings have the enhanced practical advantages characteristic of pure cadmium coatings in giving better protection than zinc with less thickness, good color of coating, and economy of current. The advantage of using mercury in combination with cadmium or zinc and cadmium is that the resultant coating is more resistant to corrosion than cadmium or zinc alone. The cathode potential is raised with consequent increased throwing power.

Such a coating may be formed by the use of a plating solution to which the proper addition of cadmium or cadmium and mercury compounds soluble in the bath have been made, or the metals can be furnished to the solution by the use of cadmium anodes and zinc anodes or alloy anodes. If mercury is not desired in the final product, a binary anode of zinc and cadmium can be used.

Examples of this invention are as follows:

Example 1. To plate steel articles such as stampings for aeroplane parts, proceed as follows: The parts are first cleaned, preferably by sand blasting until all of the scale and loose dirt are removed. They are then put in a hot alkaline cleaning solution containing from 1% to 5% of sodium hydroxide in order to preserve the clean surface. The parts so cleaned are rinsed in water and suspended from the cathode rod into a cadmium mercury alloy plating solution of the following composition:

Water	1	L. 1.	gal.
Sodium cyanide	60	G. 8	oz.
Sodium hydroxide	15	G. 2	oz.
Cadmium hydrate	15	G. 2	oz.
Mercuric oxide	0.1	G. 0.0125	oz.

Other conditions maintained are as follows:

Anodes	Cadmium
Temperature	25° C. (77°F.)
E. M. F.	3 to 6 volts.
Current	15 amperes per sq. ft.

An average analysis of the coating produced will show cadmium 98-99% and mercury 1-2%. The various ingredients of the bath must be replenished from time to time as they become depleted.

Example 2. A method of stabilizing the cadmium and mercury contents of the bath is to use a cadmium mercury alloy anode to supply the desired quantities of these metals to the solution. A composition of such an alloy anode is cadmium 98%, mercury 2%.

In plating, for example, steel fittings for aeroplane parts proceed as in Example I, with the exception that in this case, the above mentioned alloy anodes are used. A coating of similar analysis to that in Example I is obtained.

Example 3. To plate wire screen with a zinc cadmium alloy, the material is cleaned by an alkaline electric cleaner or when rusty by alternate acid and alkaline pickling until a chemically clean metallic surface is secured. The wire may then be plated in the following solution:

Water	1	L.	1 gal.
Sodium cyanide	45	G.	6 oz.
Sodium hydroxide	30	G.	4 oz.
Zinc cyanide	30	G.	4 oz.
Cadmium hydrate	7.5	G.	1 oz.

Other conditions maintained are as follows:

Temperature	25° C. (77° F.)
E. M. F.	3 to 6 volts
Current	25 amperes per sq. ft.
Anodes	zinc

The bath must be replenished from time to time as the several ingredients become depleted. An average analysis of the resulting coating will be zinc 70-75%, cadmium 25-30%.

Example 4. The zinc and cadmium contents of the bath may be stabilized by using zinc cadmium alloy anodes to supply the desired quantities of these metals to the solutions. A composition of such an alloy anode is zinc 75%, cadmium 25%.

In plating, for example, wire screen proceed as in Example 3, with the exception that in this case substitute the zinc cadmium in place of the straight zinc anodes.

Example 5. To plate steel casters with zinc cadmium mercury alloy, they are cleaned by one of the alternative methods given in Example 3 depending upon their condition. When a chemically clean surface has been obtained, they may be plated in the following solution:

Water	1	L. 1	gal.
Sodium cyanide	45	G. 6	oz.
Sodium hydroxide	30	G. 4	oz.
Zinc cyanide	30	G. 4	oz.
Cadmium hydrate	7.5	G. 1	oz.
Mercuric oxide	0.1	G. 0.0125	oz.

Other conditions maintained are as follows:

Temperature	40° Centigrade
E. M. F.	3 to 6 volts
Current	25 amperes per sq. ft.
Anodes	zinc

The bath must be replenished from time to time as the several ingredients become depleted. An average analysis of the coating obtained is zinc 70-80%, cadmium 20-30% mercury 1-2%.

This article will be concluded in an early issue.—Ed.

Whys and Wherefores of Practical Ball Burnishing

An Analysis of the Elements Involved and the Methods in Practice

By J. R. TROTT

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WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

THE real art in ball burnishing small metal parts is not so much in running the machine itself but rather in the separation of the work into classes and the establishment of a workable formula for each group. With a definite plan of procedure decided upon and turned over to the operator of the barrel for his guidance, burnishing becomes a known quantity and it is a simple matter for him to get uniformly good results on all classes of burnishable work month after month.

Since the widest possible adoption of the process as an economical and fast method of finishing small metal parts depends upon the application of a well thought out formula, let us dwell for a few moments upon the details necessary to consider in arriving at an intelligent program.

The Mechanics of Ball Burnishing

Ball burnishing is a process employing a wood or wood lined barrel, hard steel balls as a burnishing medium, and soapy water as a lubricant. It forces down (not rubs off) by a regulated mechanical half-rolling and half-rubbing pressure, the minute irregularities that make the surface of metal appear unfinished, into a high lustre. It tends also to eliminate porosity.

The functioning of the wood lining in a metal barrel is twofold. First, it serves as insulation so that the work cannot come into contact with the metal sides of the machine and become scratched; and second, it keeps the revolving mass from rubbing off particles of metal and rust (which would quickly form on the inside of the barrel above the burnishing solution when the cover was removed) into the solution and thus discolor the burnished finish.

Ball burnishing materials and their practical application is a subject that has been widely and variously discussed. If, as has been claimed, the efficiency of the process is dependent upon creating the greatest possible resistance within the burnishing mass, then, no doubt, steel cubes would be in universal use today as a burnishing medium. It would be hard to imagine any common shape that could set up as great a resistance as a mass of fair sized square blocks of steel in a barrel.

Actually, if an attempt were made to burnish with cubes as a basis, the work would come out of the barrel unrecognizable—it would be battered, probably bent, and unfinished because such terrific resistance would cause abrasion.

Round steel balls form the basis of good burnishing because they supply the fundamental "combination half-rolling—half-rubbing action" within the proper pressure range. In a mass, it is easy to see how a steel ball would rub or burnish that part of the surface of a piece of metal with which it came into contact, but if too much weight happened to be concentrated at that particular point, it would roll rather than scratch or "rub off" the metal.

Granted that a ball cannot enter an angle smaller than its own diameter and where figured work or pieces having sharp angles are involved, the introduction of some burnishing cones, pins or slugs is recommended, the exact kind depending on the particular case. It is possible to use a proportion of especially shaped materials without altering to any great extent the fundamental ball burnishing action.

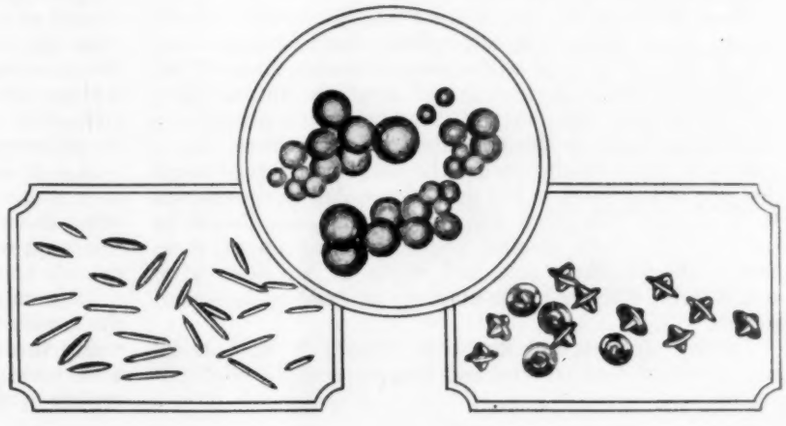
Factors to Be Considered

There are three main factors to consider in determining the proper action in a barrel for a given kind of work, namely, (1) speed of machine; (2) size or assortment of material; (3) load in machine.

The speed range depends largely on the diameter of the barrel used; the smaller the diameter of the barrel the higher the speed. A 24" or 30" machine requires about 15 R.P.M. for a light burnishing action on frail work up to 45 R.P.M. for that requiring a vigorous burnish. Within these limits, the faster the speed the quicker the finish is obtained.

Also, much depends on the size of the materials used. While small balls admittedly have more contacts with the surface, they provide a light, very mild action. Large balls supply a far heavier burnishing effect and since the large sizes cost less per pound, it is advisable to use as large a ball as practical.

Some of the burnishing material manufacturers put out a "kit" containing samples of their full offering of sizes and kinds of materials. By having one of these handy, it is possible many times by trying the different

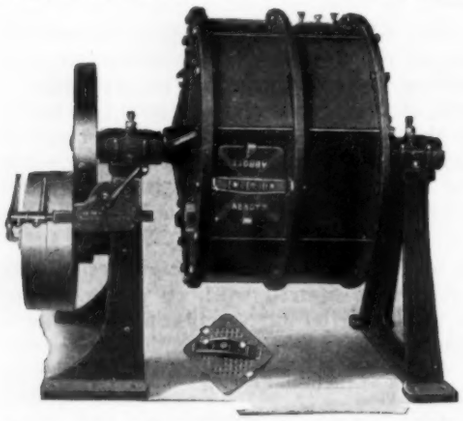


Burnishing Balls, Cones and Pins Used in the Barrel to Bring Up the Burnished Finish

sizes and shapes on the surface to determine what will produce a thorough job and yet not become lodged in any holes or recesses in the work.

With regard to quantity of materials to be used, it is always wise to be guided by the barrel manufacturers' recommendations, keeping in mind that the mass, besides supplying rubbing pressure, also serves as insulation for the work and prevents scratching.

The soap in a burnishing barrel is not introduced primarily as a cleaner, but rather as an economical lubricant. There is a wide variety of burnishing soaps on the market, but chip soap which is neutral and in thin flakes is widely used, first, because of its low water content which means



A Typical Burnishing Barrel

economy, and second, because it can be dissolved even in cold water in just a few moments.

Preparation of Work

Too much stress cannot be placed upon the importance of cleanliness in ball burnishing. The barrel, the balls, and the work as it enters the machine **must be clean.** If, through error, grease, oil or dirt of any kind is allowed to get into the burnisher, wash both barrel and balls with one of the commercial cleaners and hot water several times or until the solution runs out clean. Then rinse two or three times with plain cold water to remove all traces of the cleaner.

If there is any foreign matter in the solution the tendency is for the small particles to adhere to the surface of the balls and then be rolled onto the work in the form of a dark film. Naturally, this causes bad discoloration the extent of which depends upon the amount of dirt in the soapy water.

The preparation of the work for ball burnishing should be divided into two classes—cleaning and brightening.

As an example, let us consider cold rolled steel stampings. The surface is usually bright but as the stampings come from the presses, they are usually covered with oil. Only a cleaner bath or dip is necessary.

Here is a typical case where a brightener is required. Drawn brass work as it comes from the annealing furnaces is usually covered with a sort of smoky film. While ordinary commercial cleaners will clean the surface, they will not remove the film. If these pieces are placed in a burnishing barrel in this condition, it is easy to see that a dull color must result because the small particles of metal that are rolled down in the process are dull in themselves. In a case of this kind, a bright or acid dip should be substituted for the cleaner and a combination of three parts each sulphuric acid and water to one part nitric acid is quite effective in the majority of cases on brass and copper.

Twenty degree muriatic acid (clear) is economical and is widely used on steel and iron requiring a brightening up.

Where it is impractical to use the acid for the brightening, sometimes a little sawdust thrown into the burnishing barrel performs the same function in a satisfactory way, not through a chemical action, but rather by a very mild scouring effect.

Sometimes a piece of cyanide about the size of a walnut, when placed in the burnishing barrel will serve as a satisfactory brightener on brass work if the surface is not too dull at the beginning.

Hardness of Metal

Now let us discuss for a moment the limitations of ball burnishing from the "hardness of metal" angle.

At one time it was considered an impossibility satisfactorily to ball burnish zinc and aluminum die castings, but here again is an instance where ball burnishing has branched out and this very thing is now being done in production quantities.

Die castings on account of being soft must be ball burnished with a relatively small burnishing ball, at a low speed, and with more than the ordinary amount of lubrication provided.

Now from the hardness point of view it is usually possible to ball burnish any work whose surface is softer than the burnishing balls themselves. Occasionally, it is desirable to polish steel that is carburized or otherwise hardened and if the surface is nearly as hard as the balls, then the procedure is to use balls with Vienna Lime which, of course, sets up an extremely mild abrasive action and is very effective in a five to seven hour run.

Too much importance cannot be placed upon the quality of burnishing materials for, as has been said a great many times, it is impossible to produce a brighter color on work than the color on the materials themselves. Furthermore, experience has proven that for burnishing materials to give permanently good results, they must not only be glass hard and mirror finished, but also heat treated for toughness. In short, they should be made especially for the purpose.

Equally as well adapted to coloring the plate as to preparing the surface of the base metal, the ball burnishing process is today being used on hundreds of various kinds and shapes of work including stampings in brass, steel and aluminum, castings, forgings, die castings, threaded parts, wire forms, swedged work, etc., and each month sees its use broadened out into new fields.

Chromium on Old Nickel

Q.—We recently installed a chromium plating unit for plating copper matrices which are nickel faced. Sometimes we repair these matrices, in which case the nickel that has been worn off is replaced by doctoring up the coppery spots showing on the old matrices. This never caused us any trouble before, but now when we chromium plate the matrices, the nickel blisters and peels off where the doctoring was done. When we remove the chromium we find that the nickel adheres to the copper spot but comes off where it touches the old nickel. Can you give us any method of eliminating the difficulty?

A.—It is quite a difficult proposition to nickel plate over a nickel deposit so that the deposit will not raise when chromium plated. If you must handle your work this way, we would suggest that you flash the matrix in a cyanide copper solution before nickel plating.

It is usually customary to chromium plate directly on the copper matrix and then, when the chromium deposit wears through, to strip the chromium in dilute muriatic acid, which will not harm the surface of the matrix, and replate with chromium. —Oliver J. Sizelove.

The Chromium Electroplating Tank

Its Influence on the Health and Property Hazards Peculiar to This Industry

By KARL ALBERT HERRMANN
General Manager of Chromeplate, Inc., New York

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

THE various phases of modern industry in general, have had the advantage of a slow enough development period to allow for the perfecting of various details, thereby allowing the output to meet growing demands. Chromium electro-plating, however, presents the direct antithesis of this condition. It is one of the newest phases of industry and still the demand for this type of finish is such that many conditions have had to be permitted until scientific and technical research have been able to eliminate them entirely or minimize them to an extent where they no longer presented an obstacle.

The fact that chromium could be applied electrolytically as a coating has been known for many years, but its commercial application has presented many obstacles. Many noted scientists, chemists and engineers all over the world have been investigating this industry and have conducted intensive researches over long periods of time. The net result of this has been the compilation of much valuable knowledge; the period of the last three years especially has seen some real advances made that have enabled this industry to obtain a firm footing in the realm of true commercial production. Their findings and recommendations on correct bath temperatures, proper proportions of chemicals to be used, maximum and minimum current and voltage ranges, at which proper plating can be obtained, are today common knowledge. They have dealt exclusively, however, with the chemical and electrical phases paying little or no attention to two vitally important factors: (1) the health hazards to the operators; (2) the tank used for plating. Either of these two factors is at present doing more to prevent further advances being made than any other single factor now being contended with. We shall discuss these in the order named.

Engineers in general and of all the big corporations in particular today realize that output depends on labor efficiency, that it is vitally essential to keep the standard of health up to the highest point possible. They take every possible means of eliminating any health hazards that confront the operators due to any particular operation or process. Vast sums of money have been expended for this purpose. In the chromium plating industry they have overlooked this factor, or at the best, have been haphazard in their methods of prevention. The net results of this have been alarming. No less an authority than the U. S. Health Service has made a report in Vol. 43, No. 36 of September 7th, 1928. This was compiled by J. J. Bloomfield and Dr. William Blum under the heading of "Hazards of Chromium Plating." (See page 324 of this issue). Six plants, having as part of their equipment chromium electroplating, were investigated by them. It was found that out of twenty-three operators, four of whom were employed in other departments, twenty had received injuries in one form or other from the chromic acid. The average period of employment was six months.

If such conditions were to continue to prevail throughout the entire industry, it would only be a matter of time before efficiency would be lowered to a degree that would make it a prohibitive proposition in every respect. It would appear that not one operator is immune, that they are working in an impaired condition of health or that it would be essential to have on hand substitutes at all times to replace them until they have regained a normal condition. Furthermore, it would be increasingly difficult to obtain operators at all. Also the insurance companies and the health authorities would impose such penalties as would make it further prohibitive.

A fundamental reason, without doubt, for this condition, is the insidious manner in which chromic acid causes injury. The actual injury does not become acute until long after the injury has been caused. No pain is felt for a long while after contact with it and then, for the first time we become aware of it. By that time, the injury is of a very serious nature. There have been many cases where permanent and very painful injuries have been the result, although it can be said that the majority have not proved so. Chromic acid can attack the body in two forms: (1) by contact with the fumes; (2) by contact with the solution. Chromic acid present in the form of fumes around the tank and in the immediate neighborhood, is subject to inhalation by those in its immediate vicinity. Therefore, one of the most prevalent injuries is that to the nasal septum. Cases are on record where the nasal septum has been almost entirely perforated before its presence was made known. Injuries to the membrane of the eye are also frequently caused by these fumes. Direct contact with the solution is always dangerous. This can be caused in many ways, by splashing, spilling, etc., when putting in or removing work from the plating tanks. When it comes in contact with the skin at any point, immediate removal is imperative in order to prevent injurious results. However, by far the most dangerous and far reaching of the two in its effects on the human body, is contact with the fumes.

The use of proper preventive methods before an operator starts will materially help to reduce the hazards due to contact with the solution. Some of the following are positively invaluable and should be in force at all plating plants.

1. A complete change of clothing daily.
2. All-leather shoes to be very well oiled because leather deteriorates very rapidly when in contact with chromic acid, and will allow the acid to work through.
3. The use of aprons, sleeves, knee or leg protectors, made of some acid-proof material to be used in part in accordance with the possibilities of spilling or splashing. Even a very small drop of the solution will penetrate clear through the average type of clothing worn.
4. The application of vaseline in the nostrils of the operators while in the plating room.
5. The immediate application of the following ointment to any part of the skin that the solution has touched.

Petrolatum (paraffinum-molle of the B. P. 3 parts).
Lanolin (1 part).

Melt in water, bath or stove. When melted and thoroughly

mixed, add 10 to 15 drops of 90 per cent pure carbolic acid to every 400 grams, or 5 drops to every 4 ozs. of the mixture.

Pour into a glass or jar and allow the mass to solidify.

It is now ready for use. To apply:

Let the user clean his hands and arms thoroughly with soap and water and while still moist, apply the ointment. Rub in well so that all exposed skin is covered. This should be done for about two or three minutes, then wipe dry with a clean cloth. (There will be no greasy feeling.) Lanolin is absorbed by the skin and the petrolatum forms a light coating on the surface. Application of the two inert substances prevents harmful action of the chromic acid upon the skin surface, and the absorbed grease also prevents action of the acid should the outer coating of petrolatum wear off.

It is very effective and its immediate use assures prevention of injuries. We are indebted to Mr. Levi, chemist for the Pfister & Vogel Leather Company, of Milwaukee, for this very efficient product. Its cost is nominal, approximately 50c a lb. and can be obtained at any drug store.

6. Be sure when using gloves of any kind, particularly those made of rubber, that they are free from pin holes of any kind. Chromic acid finds its way through these very readily. The hands being in a warm moist condition are subject to the immediate action of the acid.

The prevention of fumes from creating health hazards presents an entirely different proposition. These fumes are formed from the spray generated by gasification in the electroplating. If left alone they are lifted on the surrounding air currents and circulated. In this manner any room containing a chromium electroplating tank becomes a place fraught with grave danger to the welfare of the operators as well as a source of eventual destruction to surrounding objects with which it comes in contact. The extent of this hazard is in direct proportion to the amount of fumes allowed to circulate in this fashion. The method employed to prevent this at present is to draw off the fumes by means of an exhaust system whereby they are drawn in one direction through a metal duct or pipe and finally forced into open space some distance away from the plating operations.

The fact remains however that the duct through which the fumes are drawn, the exhaust blower itself and the surrounding objects in the space into which they are finally exhausted, are all subject to its corroding action and ultimate destruction.

It is only a matter of time when the initial efficiency, no matter how high, is lowered to a serious degree and when the fumes will ultimately eat through the duct, allowing them to circulate through the plating room.

There are two types of exhaust systems in general use. One uses a hood placed at some distance above the rim of the tank and covering the whole surface of same, to which the metal duct or pipe is attached. This is both inefficient and dangerous; inefficient because such a hood at all times, hampers the operator, preventing him full access to the tank, and dangerous because it draws the fumes past his face and presents the constant menace of injury by inhalation.

The other system uses exhausts which begin at the lip of the tank and run parallel to it. They are generally placed on the two sides having openings 1½ in. wide at one end, 2½ in. at the other facing downward, the narrowest end being placed nearest to the duct leading to the exhaust fan. The bottom of these exhausts are slightly inclined so as to allow the gathering of residual chromic acid at one point where a pet-cock (steel) is welded to it so as to draw it off from time to time. This should be done often, as it has a tendency to coagulate and block up the exhaust line.

To prevent any great amount of fumes from passing through the duct and striking the blower, screens made of charcoal are inserted in the duct before reaching the blower. These screens are made by filling steel wire containers of the proper size. To prevent fumes from being exhausted into the atmosphere, another of these screens is placed in the duct leading from the blower to the atmosphere. This method, while productive of results, is cumbersome, does not reclaim any chromic acid and must be frequently attended to because the wire is subject to renewal. In addition, a substantial increase in power is required to exhaust the same amount of air as when there are no screens used.

Under any circumstances it is necessary to exhaust at least 100 cu. ft. of air per minute per sq. ft. of tank surface to carry off the fumes. It can therefore readily be seen that any such method as that of using charcoal screens must take into consideration the power consumed.

Chromic acid is one of the most active corrosive agents known and even very small quantities, unless properly controlled, are an ever-present source of danger to the human being and property, especially when present in the form of fumes.

One firm has investigated these problems along lines that represented a radical departure. They assumed that these fumes must in some way be taken care of at the point of origin, right at the cathode bar if possible; that it was too late to attempt their control or elimination after they had risen into the exhaust duct. This meant that the plating tank itself must provide the necessary means. They realized that whatever the remedy was, it must be simple enough in design to assure a cost within reason, to be fool-proof and to in every way help increase production without sacrificing quality.

The tanks most generally in use today are made of steel, single walled with the seams welded. Many designs of corners have been made to reduce the hazards of leakage due to acid action or to readily locate and quickly repair in case it did occur. Steel and iron are metals that are immediately subject to corrosion by chromic acid. Therefore if the plating solution is placed in a tank made of steel or iron and in direct contact with the metal itself, it will only be a matter of time before the tank is destroyed. In fact, cases have occurred where the solution broke through and spread to surrounding objects causing serious damage. Linings have been put in, such as lead, slate or glass, but unless these are absolutely free from imperfections such as pin holes, etc., and unless great care is taken while operating the tank not in any way to damage them, they prove ineffective and fail to prevent the acid from attacking the tank.

The average plant in order to heat and cool their solution place coils of pipe at the bottom of the tank to allow water or steam to pass through as the case may be. The same problem presents itself of the acid attacking them as with the tank. Many cases are on record where the solution has broken through the coils and ran down back corroding and destroying much accessory equipment.

Another point to stress is the loss of solution itself. This is a factor that must at all times be considered. Solutions are costly and any losses represent real money. Further, the loss of solution by fumes, which may represent as much as 25 per cent of that consumed in deposition, builds itself up over a period of time into a cost item that cannot be overlooked.

A tank has been developed of very simple and rugged construction. It is of double walled design, made of special metal and construction that insures long life and freedom from chromic acid hazards. All around the inside walls and directly above the surface of the solution are series of vents leading down into the spaces between

the walls of the tank. The duct or pipe leading to the exhaust blower is attached to the end of the tank at the top and opens into the spaces between the tank walls. The walls are not more than seven inches apart, making the design very compact and taking up very little space. The vents are so designed that the suction created by the exhaust never allows the fumes to rise to a point where they would prove in any way harmful to the operators but draws them downward through the vents into the space between the tanks. At this point, by a special arrangement the fumes are broken up, separated from the exhaust, recondensed and automatically returned through the vents down the sides of the tank to the solution. Only air is carried upward through the duct to the exhaust blower and into atmosphere. It is stated that 98 per cent or more of the chromic acid in the fumes is returned to the solution by this method.

The fumes are at no time allowed to travel to a point where they can become a hazard. In this manner safety to the operator and to the surrounding property is at all times assured.

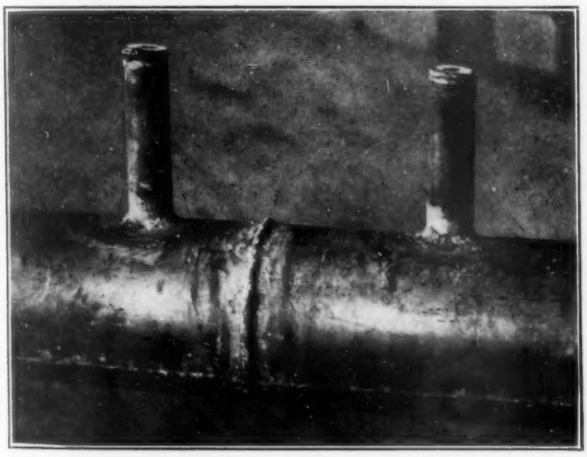
They have also eliminated the heating of coils at the bottom of the tank by a simple arrangement in the space between the walls of the tank that cools off and heats up the solution at a far more rapid rate, at the same time eliminating the hazards that are present when using coils.

The space in this tank is entirely available for work. The operator can work in perfect safety and freedom without hindrance from hoods or other obstacles.

Welding Monel Metal

Success in welding Monel metal requires a knowledge of the properties of this alloy and of its peculiarities under the welding flame.

Monel metal is an alloy of nickel and copper containing about 67 per cent nickel, 28 per cent copper, with 5 per cent of other elements as iron, manganese, silicon, and carbon. In appearance Monel metal when new resembles untarnished nickel. Probably the most valuable property of Monel metal is its resistance to corrosion. For that reason it is used extensively in food handling machinery,



Welded Monel Header Used in Chemical Plant

textile dyeing machinery, photographic tanks, pickling tanks, marine construction and in chemical equipment.

In welding Monel metal a few simple precautions must be observed. First, a neutral flame should be used. The tip should be one or two sizes larger than would be required for steel of the same thickness. Cold drawn Monel metal wire or strips cut from sheet, should be used as welding rod. As a general rule, flux is not required. The oxide film that forms on the surface of the puddle helps to protect the metal underneath from further oxidation. Keeping the outer envelope of the flame spread over the weld area will also aid in excluding air. The rod should be melted under this skin of oxide and slag. Any particles of dirt or foreign matter should be worked up into the slag by melting underneath them. Then, when the weld is built up well above the surface, as all Monel metal welds should be, grinding will remove all oxide, slag and impurities, leaving only good sound metal in the weld.

Monel metal castings present a peculiar combination of properties. Like gray cast iron, they are sensitive to sudden temperature changes while under the welding flame. Consequently in welding such castings they must be carefully preheated, welded while hot and allowed to cool very slowly. Like cast aluminum, Monel castings have very little strength when hot so the piece must be properly supported in the preheating furnace in order that the various parts of the casting do not collapse or distort under their own weight. The casting should be brought to an even dull red heat of about 1,200 deg. F. and the temperature maintained as steady as possible during the welding.

When the weld is completed cover all openings of the preheating furnace with asbestos paper, close the draught holes with sand and allow the casting to cool gradually in the dying fire. Do not uncover until the casting is stone cold. It is most important that the annealing process be carefully carried out as success depends largely upon this factor.

Installing a Chromium Unit

Q.—We intend to install a chromium solution in our shop and we would appreciate your advice on the following points:

Is there any special nickel plate for the under-coat? should the nickel be potashed or just dusted off?

Is a tank 24 in. wide large enough for automobile radiator shells? Does it matter whether the shells are hung upright or horizontally? Does the tank require any particular kind of lining?

What is the best means of chromium plating die cast articles?

A.—A tank 2 feet wide should be wide enough to plate a radiator shell, although one 2½ feet wide would be better. Radiator shells are usually plated with the top of the shell to the bottom of the tank.

Die cast metal should be plated in the following solution and colored before chromium plating:

Double nickel salts	10 oz.
Sodium chloride	7 oz.
Boric acid	2 oz.
Sodium citrate	1 oz.
Water	1 gal.

Temperature 80° F. Strike with 4 volts for few seconds and then reduce to 2 volts.

—Oliver J. Sizelove.

Standards for Brass and Bronze Gear Blanks

Proposed Standard Practice for Non-Ferrous Gear Materials and Blanks Submitted by the American Standards Association for Criticism

THE American Standards Association offers the following American recommended practice for specifications of gear materials and blanks of bronze and brass. T. D. Lynch, consulting metallurgical engineer of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, was chairman of this committee which compiled these recommendations. Clifford B. Le Page is acting secretary of the general committee on gear standardization. Suggestions or comments should be addressed to him at 29 West 39th Street, New York.

1. **Material Covered.** These specifications cover non-ferrous metals for spur, bevel and worm gears, bushings and flanges for composition gears.

2. **Basis of Purchase.** This material shall be purchased on the basis of chemical composition.

3. **Process.** The alloys may be made by any approved method.

4. **Use and Chemical Compositions.** (a) For spur and bevel gears, hard cast bronze, A.S.T.M. B-10-18, S.A.E. No. 62, and the well-known 88-10-2 mixture to the following limits:

	Per Cent
Copper	86-89
Tin	9-11
Zinc	1- 3
Lead	0.20
Iron (Max.)	0.06

Good castings made from this bronze should give the following minimum physical characteristics:

Ultimate strength	30,000 lb. per sq. in.
Yield point	15,000 lb. per sq. in.
Elongation in 2 in.	14 per cent

(b) For bronze worm gears, two alternative analyses of phosphor bronze are recommended, S.A.E. No. 65 and No. 63.

S.A.E. No 65, called phosphor gear bronze

	Per Cent
Copper	88-90
Tin	10-12
Phosphorus	1- 0.3
Lead, zinc and impurities (Max.)	0.5

Good castings made from this alloy should give the following minimum physical characteristics:

Ultimate strength	35,000 lb. per sq. in.
Yield point	20,000 lb. per sq. in.
Elongation in 2 in.	10 per cent

S.A.E. No. 63, called leaded gun metal.

	Per Cent
Copper	86-89
Tin	9-11
Lead	1- 2.5
Phosphorus (Max.)	0.25
Zinc and impurities (Max.)	0.50

Good castings made of this alloy should give the following minimum physical characteristics:

Ultimate strength	30,000 lb. per sq. in.
Yield point	12,000 lb. per sq. in.
Elongation in 2 in.	10 per cent

These alloys, especially No. 65, are adapted to chilling for hardness and refinement of grain. No. 65 is to be preferred for use with worms of great hardness and fine accuracy. No. 63 is to be preferred for use with unhardened worms.

(c) For bronze bushings for gears, S.A.E. No. 64 is recommended as satisfactory, of the following analysis:

	Per cent
Copper	78.5-81.5
Tin	9 -11
Lead	9 -11
Phosphorus	0.05-0.25
Zinc (Max.)	0.75
Other impurities (Max.)	0.25

Good castings of this alloy should give the following minimum physical characteristics:

Ultimate strength	25,000 lb. per sq. in.
Yield point	12,000 lb. per sq. in.
Elongation in 2 in.	8 per cent

(d) For brass flanges for composition pinions, A.S.T.M. B-20-32, and S.A.E. No. 40 is recommended. This is a good cast red brass, of sufficient strength and hardness to take its share of load and wear under conditions of style No 2 of the A.G.M.A. standards for composition gearing, a design in which the flanges mesh with the mating gear, and therefore ample for style No. 1. The composition is as follows:

	Per Cent
Copper	83 -86
Tin	4.5- 5.5
Lead	4.5- 5.5
Zinc	4.5- 5.5
Iron (Max.)	0.35
Antimony (Max.)	0.25
Aluminum	None

Good castings made from this alloy should give the following minimum physical characteristics:

Ultimate strength	27,000 lb. per sq. in.
Yield point	12,000 lb. per sq. in.
Elongation in 2 in.	16 per cent

5. **Chemical Analysis.** An analysis of each melt shall be made by the manufacturer. The chemical composition thus determined shall be reported to the purchaser or his representative and shall conform to the above specifications.

6. **Sampling.** (a) The sample for chemical analysis may be taken either by sawing, drilling, or milling the casting, or test coupon, and shall represent the average cross-section of the piece.

(b) The saw, drill, cutter or other tool used shall be thoroughly cleaned. No lubricant shall be used in the operation, and the saw dust or metal chips shall be carefully treated with a magnet to remove any particles of iron.

THE METAL INDUSTRY

With Which Are Incorporated

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Editorial

The Electroplaters' Convention

THE annual convention of the American Electroplaters' Society was held in Detroit, Mich., July 8-11. As this issue of THE METAL INDUSTRY went to press on July 5th, it was impossible for us to include any news of the convention. In our June issue we published complete advance information about the program and the other points of interest. Normally, this issue of our journal (July) would give complete reports, but the arrangement of dates has made it impossible.

A complete review, giving all details of the convention, will be published in our August issue, which will be in the hands of our readers about August 10th.

How Matter Is Constructed

THERE was a time, not so many years ago, when we were satisfied to believe that all materials were made up of molecules and molecules of atoms. And that was as far back as we could go. This was a "theory," of course, admittedly so, but it was useful and resulted in a much wider power over the materials used for our daily needs. Only recently, however, new theories have been developed, broadening our conception or perhaps deepening them—so that we consider the atom no longer the ultimate subdivision of matter. Atoms are now believed to be made up of electrons, which are grouped about a nucleus. This is also a "theory," but this theory explains many phenomena, which were formerly not understood.

In the Fourth Edgar Marburg Lecture before the American Society for Testing Materials at Atlantic City in June, Dr. Dushman, assistant director of the Research Laboratory of the General Electric Company of Schenectady, N. Y., expounded the theory of cohesion and atomic structure in materials. (For a report of this meeting see pages 322-4 of this issue.) The crystal structure of pure metals shows a definite connection with electronic arrangements, and certain properties, such as ductility and malleability, are observed to be intimately dependent upon the type of lattice structure. Most interesting results have been obtained from investigations on the tensile behavior of single crystals. Temperature has a very definite effect upon the rupture strength of metals, a rise in temperature causing a drop in strength.

Work of this type seems abstruse, involved and often useless to the practical man. But there is no sounder truth than the fact that such theoretical work is the basis of solid advancement in the practice of using nature's raw materials. Many inventions come from the amateur, many from lucky accidents, many from the man of experience with no understanding of the basic principles of his art. But the most enduring and worth while structures are those built on the solid foundation of a thorough understanding of basic principles; theories, proved experimentally, then put into practice and then translated into practical working terms.

Stabilizing Aviation

IN the history of every new industry, there is a period of flux in which business shifts rapidly from group to group. A large number of companies are formed to ride the crest of the wave, and when the boom is over, the mortality is extremely heavy. Eventually the industry settles down to a few large producers and as many small ones as are adequately staffed and equipped.

That American business has learned from past experience is proved by the rapid flow of events in aviation. Within a year or two after the formation of a large number of companies manufacturing airplanes and accessories, and commercial air transportation companies, mergers are taking place to solidify and unify as many as possible of these organizations into a few strong groups. According to published reports, there are now four main groups in aviation, The United Aircraft and Transport Corporation, or Boeing group; the Curtiss, or Keyes group; the Wright, or Hoyt group, and the Aviation Corporation, or Harriman group. Now the Curtiss and the Wright groups have combined. In addition there are about sixty independents at this time, but the trend seems to be for the larger groups to pick up these independents as it is found advisable or profitable.

Aviation is now an industry commanding a total business of about $100,000,000 a year. It has swallowed up a number of manufacturing companies, formerly independent and large enough, even as individual entities, to command respect, such as the Sperry Gyroscope Company, the Stromberg Carburetor Company, and Pratt and Whitney. It has lost no time in buttressing itself against storms which are sure to come.

All of this promises well for those who look to aviation as a source of revenue. Manufacturers of metals,

which are most important as raw materials, are sure to be benefited by the increased stability and soundness of their customers. The leading article in this issue by J. F. Hardecker (see pages 315-318) shows the importance of the heavy metals to aviation. While aluminum is perhaps the greatest single beneficiary among the metals, nickel alloys, copper and other metals will profit in no small way.

Intelligence and Wealth

DOES it take brains to acquire wealth? Academic as it may seem, this question has been the source of countless acrimonious debates, particularly among those who are not rich. Those extremists, who are by nature hero worshippers, claim that only by the exercise of great intelligence can fortunes be built up. They even admit their own ineptitude and in some peculiar instances even take a strange pride in the success of others whom they have never seen. At the opposite pole are those who say brains have nothing to do with it. Riches come to those who are lucky. They point to the great scientists, artists and philosophers who remain poor, and take comfort therefrom, excusing their own failure to rise above the common herd of needy souls.

Considerable publicity was given recently to a statement by Julius Rosenwald, the head of Sears, Roebuck and Company, who stated in public:

"Entirely too much stress is put on the making of money. That does not require brains. Some of the biggest fools I know are the wealthiest. As a matter of fact I believe that success is 95 per cent luck and 5 per cent ability. Take my own case. I know that there are any number of men in my employ who could run my business just as well as I can. They did not get the breaks—that is the only difference between them and me."

Mr. Rosenwald is one of the best known and most highly respected of American business leaders, both for his ability and his eminence in philanthropy. Consequently attention must be paid to such a statement from him, even though it may be only half right. Too much stress is placed on the making of money. Wealth should not be the be-all and end-all of life. The best that can be said for money making as an aim is that it is a necessity—unfortunate perhaps, but still a necessity. Some wealthy people it is true, are not particularly intelligent. They may have been lucky, acquiring their wealth by fortunate speculation, taking the good advice of others, by inheritance or any other easy method. As a general rule, however, those who have acquired wealth by their own efforts are anything but stupid. A few have had luck or the "breaks," but they would have acquired wealth, that being what they were after, in spite of everything.

Mr. Rosenwald is probably right in saying that there are men in his employ who could run his business well. He is also right in saying he got the breaks and they did not. What he overlooks, however, is that the breaks rarely come to the unintelligent. They may also evade plenty of good men who will not get as far along as they should, but in spite of this they will achieve a certain measure of success. By and large, and always allowing for a fair percentage of exceptions, the man of intelligence who applies himself to the making of money, will get it. The man of small ability will not. Those of superior intelligence whose efforts are bent in other directions, will probably achieve success which is to them preferable to financial reward. They may be great teachers, artists or scientists and get their satisfaction in ways which are preferable to dollars and cents. A stupid person who achieves "success," financial or otherwise is the rare exception.

A Hero of Peace

THOMAS A. EDISON is enjoying the celebration of the 50th anniversary of his invention of the incandescent electric lamp by the whole United States. On May 31st, was initiated at Atlantic City the world-wide tribute to the great inventor in the Festival of Light.

Mr. Edison's life is proof-positive of the fact that fame can come to men of peace as well as men of war, and to men of science and industry as well as men of government and politics. As an inspiration to youth in this industrial age, the majority will find him infinitely more worth while than the victor in great battles.

Very few great men have lived to enjoy the public recognition of their work to the extent of Mr. Edison, but no one has ever deserved better the approbation.

Government Publications

Publications listed hereunder are obtainable from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., at the prices given, unless otherwise noted.

Tin in 1927. By J. W. Furness. Department of Commerce, Washington, D. C. Price 10 cents.

Magnesium and Its Compounds in 1927. By J. M. Hill. Department of Commerce, Washington, D. C. Price 5 cents.

Market Research Agencies. 1928 edition. Department of Commerce, Washington, D. C. Price 15 cents.

Cadmium in 1927. Department of Commerce, Washington, D. C.

Lead in 1927. (General Report) Department of Commerce, Washington, D. C.

Coated Abrasive Products. Simplified Practice Recommendations R89-28. Department of Commerce, Washington, D. C. Price 10 cents.

Simplified Practice. What It Is and What It Offers (1928 edition). Department of Commerce, Washington, D. C. Price 15 cents.

The Marketing of Antimony. By J. W. Furness, chief, Minerals Division, Department of Commerce. Trade Association Bulletin No. 624. Price 10 cents.

Secondary Metals in 1927. Bureau of Mines, Department of Commerce. Pages 373 to 392 of Mineral Resources of the United States, 1927—Part 1. Published April, 1929. 5 cents.

Alphabetical Index and Numerical List of United States Government Master Specifications. Promulgated by the Federal Specifications Board. Circular of the Bureau of Standards No. 371 Department of Commerce, Washington, D. C.

Proposed Master Specification for Pipe Fittings, 125 Pounds Brass or Bronze (Threaded). For copies of this Specification, write to Federal Specifications Board, Washington, D. C. Suggestions on it should be sent to this Board before August 6th.

Correspondence and Discussion

Specify Anode Distance

To the Editor of THE METAL INDUSTRY:

We have just had the pleasure of a visit from C. H. Proctor, and I have mentioned to him that in connection with publications on plating solutions that in cases where voltage is specified, the anode distance should also be given as they are direct functions of one another. I am writing you at Mr. Proctor's suggestion. pointing out this fact. I think it would be a good thing for the plating industry generally if that could be carried out.

THE METAL PROTECTION COMPANY,
F. M. Dorsey, President.

Cleveland, Ohio.
May 20, 1929.

To the Editor of THE METAL INDUSTRY:

It has been the custom in the past to refer to a certain voltage as a guide to the operator of a plating solution whereby he could have some means of determining the amount of energy that was necessary to produce certain results.

In all research work that is being done reference is made to a certain current density, and this is the correct way of recording the amount of current that has been used to produce certain results.

Current density is amperage, and it is the ampere that does the actual work of depositing a metal from a solution of metallic salts, the voltage being the pressure that is required in making the ampere do the work.

It would be far better, I believe, to refer to anode and cathode current density and disregard the voltage to a certain extent as better results would be obtained.

The distance between anode and cathode does have a direct bearing on current distribution. The ratio of anode and cathode current density makes a marked effect on current distribution also.

The plater in general is becoming better educated, and I believe that it is the duty of those that are in any way connected with the publishing of an article referring to plating to help him along. I think that this gentleman has raised a question that is well taken and that it should be given publicity so that others may have an opportunity of expressing their views and all will benefit by friendly discussion.

OLIVER J. SIZELOVE.

Newark, N. J.
June 3, 1929.

New Books

Industrial Explorers. By Maurice Holland. Published by Harper and Brothers. Size 5½ x 8½, 347 pages. Price, $3.00.

Here is an absorbing week of evenings' entertainment for those interested in science and research. The author has given biographical portraits of nineteen of the best known industrial research experts, showing how their discoveries aided the progress of mankind. Every one of these stories is interesting regardless of what may be the special work of the reader, but to metal men this book has a closer meaning. One of the men described is W. H. Bassett, Technical Superintendent of the American Brass Company, in a chapter entitled, "Little Grains of Copper." The story is told of Mr. Bassett's organization of the research and technical control department of the American Brass Company, the improvements effected in the manufacture of wrought brass and the effect of these improvements on the industries into which the brass went.

Every chapter has its own appeal, however, and we recommend this book to anyone engaged in industry, or for that matter, out of it.

Transactions American Foundrymen's Association for 1928. Published by the American Foundrymen's Association, 222 W. Adams Street, Chicago, Ill. Size 6 x 9, 934 pages.

The publication of the annual volume of Transactions of the American Foundrymen's Association is always an event of note. The 1928 book has the proceedings of the thirty-second annual meeting, held in Philadelphia, Pa., May 14-18, 1928. It includes, of course, all the non-ferrous metal papers read at that meeting, which were published in full or in abstract in THE METAL INDUSTRY.

This volume should be an indispensable part of every progressive brass foundryman's library.

Dollars and Sense. By Charles E. Carpenter. Published by Doubleday, Doran and Company, Garden City, N. Y. Size 5 x 7, 256 pages. Price, $2.00.

The author, who was president of E. F. Houghton and Company, Philadelphia, until his recent death, wrote this book in answer to one which had appeared previously, entitled, "Your Money's Worth." Mr. Carpenter's thesis is that advertising is a great constructive force and results in great savings, combating the view of "Your Money's Worth," that advertising is largely wasteful in character, in this day and age at any rate. Mr. Carpenter also objects to standardization in principle and in practice.

The book is readably written by a person with strong ideas. Few progressive people with an insight into economics will agree with him, however, that standardization is bad or that advertising as generally conducted to-day is almost perfect. The book has, however, the faculty of making its friends agree with it warmly.

Index to A. S. T. M. Standards and Tentative Standards as of September 1, 1928. Published by the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa. Size 6 x 9, 95 pages.

The American Society for Testing Materials has made a special point of distributing these indexes to all who are interested. It will be a valuable aid in ascertaining whether the Society has prepared a specification or test covering a given material.

Daily Metal Trades Differential Handbook. Edited by W. S. Doxsey. Published by Penton Publishing Company, Cleveland. Size 5 x 8, 80 pages. Price, $2.50.

This new booklet puts all the standard differentials and mixtures for the commonly used metal products at the fingertips of the reader. It is altogether price data, largely on iron and steel products, but covers also galvanized iron, tin plates, etc.

Wire and Wire Products Directory, Index and Buyers' Guide. Published by Quinn-Brown Publishing Corporation, New York. Size 6 x 9, 126 pages. Price $5.

This is the second edition of the annual directory which presents a list of manufacturers of bare and covered wire, fabricators of wire, and supplies and equipment used by both.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

Associate Editors { H. M. ST. JOHN, Metallurgical; W. J. PETTIS, Rolling Mill; W. J. REARDON, Foundry; P. W. BLAIR, Mechanical; O. J. SIZELOVE, Testing-Analytical

Acid Zinc

Q.—I would appreciate it very much if you will inform me as to the proper addition to make to my acid zinc solution to make it plate brighter.

I am running a 1500 gallon solution in an automatic conveyer tank. I only add acid to this solution to keep it at its proper density.

Hydrometer Test—23 Bé
pH. 3.8

A.—Analysis of solution:

Zinc sulphate	22.4 oz.
Ammonium chloride	14.2 oz.
pH.	3.6

Solution is low in zinc sulphate and very high in ammonium chloride. If you will lower the pH. to 2, the metal content will be increased, which is necessary. Your metal content should be 32 oz. zinc sulphate per gallon.

To make the solution plate brighter, would recommend the addition of 2 oz. of aluminum sulphate per gallon.—O. J. S. Problem 3,862.

Black on Brass

Q.—Enclosed are some small brass parts. We would like to know how to make these black. We would do these in lots of about 40,000.

A.—A black finish can be produced upon the small brass dial hands as follows:

1. After fabrication cleanse from oil, etc., by immersion in a solution heated to 200° Fah. composed as follows:

Water—1 gallon. Any regular commercial cleaner 4 to 6 ozs.
or Caustic Potash—2 ozs.
Soda Ash—2 ozs.
Tri Sodium Phosphate—2 ozs.

After cleansing, wash the articles in cold and boiling waters, they can be cleansed in quantities by the aid of the usual vitreous acid dipping baskets.

2. Prepare an acid dip as follows:

Nitric Acid 38° 1-Gallon
Sulphuric Acid 60° 1-Gallon
Water—1 Pint
Muriatic Acid 1-oz.

Mix in any quantity desired the day before use. Keep the receptacle cool by placing the glazed earthenware container in a tank surrounded by running cold water. The acids must be kept cool

Immerse the cleansed and dry brass articles in the acid dip for a moment; move them rapidly so that all pieces will be bright; then remove from the acid dip quickly and wash very thoroughly in cold running water.

Black Dip

Prepare the black dip as follows:

Aqua Ammonia 26°—1 Quart
Dry Copper Carbonate—16 ozs. } Part No. 1

Water 160° Fah. 2 Gallons
Soda Ash 3 ozs. } Part No. 2

Mix No. 1 and No. 2 separately; then add No. 1 to No. 2; stir thoroughly. Immerse the cleansed and acid dipped brass parts in the black dip for a moment or two until black; then remove them, wash in cold and boiling waters; then dry out by the aid of a sieve and hard wood sawdust.

Finally oil or lacquer to protect the black finish from oxidation.
—C. H. P. Problem 3,863.

Blistered Cadmium

Q.—We are having difficulty in procuring cadmium plating that will come up to specifications of the N. A. C. A. in thickness and finish.

Would you kindly advise what the causes of staining and blistering would be, giving us a few ideas as to how to overcome this?

A—Analysis of solution: Cadmium oxide 4.22 oz.; free cyanide 4.26 oz.; Na OH (Caustic soda) 2.97 oz.

Analysis shows solution to be too low in free cyanide. Would recommend the addition of 5 oz. of sodium cyanide to each gallon of solution. The low free cyanide content is the cause of the work staining so easily. The blistering undoubtedly is due to an excessive current density. Use 10 amperes per sq. ft.—O. J. S. Problem 3,864.

Bright Brass

Q.—I have come to you for a little information. I am in a brass casting business. Dipping the work in sulphuric and nitric acid and coming out is satisfactory but it loses lustre afterwards. What can I do to remedy this? I also dip it in cyanide to bring the lustre up, but it seems to lose the lustre shortly afterward.

A.—Your procedure in acid dipping your brass castings is correct. The final cyanide dip removes any oxide that forms upon the castings following the acid dips.

It is difficult to maintain a permanent bright color upon the castings without the use of a laquer of some kind. A good soap dip immersion would result in a film of soap upon the castings that would maintain the lustre for a considerably longer period.

Try the following: proceed along the lines you now do up to the point of the final cyanide dip and water washing. Now prepare a neutral soap dip by dissolving one ounce of soap chips in each gallon of hot water that may be used to prepare a solution of sufficient volume to immerse the castings in, uniformly. Let the soap dip cool down to normal room temperature, then immerse the castings in the soap solution, following the usual procedure. Then remove them after a few moments' immersion and rinse them in boiling hot water as an aid to drying them out.

We believe you will obtain a more lasting finish upon the castings from this added operation.—C. H. P. Problem 3,865.

Changing Silver to Nickel Tank

Q.—We are considering changing one of our silver tanks over to a nickel tank. The tank in question is a 100 gal. tank and runs about 2 oz. silver to gal. If we discontinue using silver anodes, and substitute nickel anodes, adding cyanide of nickel instead of silver, will this tank eventually become a nickel tank?

A.—You can never change over a cyanide of silver to a normal nickel plating solution. Nickel does not deposit from a cyanide solution. The solution of your problem would be to use either hard sheet steel or nickel anodes and deposit all of the silver out of the solution upon very thin sheets of silver.

A nickel solution does not cost more than ten to twelve cents per gallon based upon the following formula:

Water 1 Gallon	Boracic Acid 2 ozs.
Double Nickel Salts 8 ozs.	Ammonium Chloride 2 ozs.
Single Nickel Salts 4 ozs.	

To prepare the 100 gallon solution put 50 gallons of cold water in the tank then dissolve all the salts as outlined in the remaining 50 gallons of water heated to 180° Fah. in the order given. Then add to the cold water and mix thoroughly. Use anodes 95-97% cast nickel. Voltage 3½ to 4½, at 10 amperes per square foot of surface area.—C. H. P. Problem 3,866.

Core Coating

Q.—We are making lead pumps up to 600 lbs., and have a great deal of trouble with the lead burning into the cores. Our core mixture is ⅓ Albany heap sand, 2/3 Lake sand, with flour as a binder, as the oil cores burn in worse. Then we wash the cores with molasses and plumbago. I would like to have any information you can give me on this question.

A.—We suggest you use the same mixture of sand you are using and the same core wash, and paint your cores over your wash with Portland cement mixed to the thickness of cream. Apply while the core is warm (not hot) and let dry thoroughly before using. This should remedy your trouble.—W. J. R., Problem 3,867.

Gun Metal on Aluminum

Q.—We would be obliged if you could suggest a method for blueing die cast aluminum or finishing in gun metal.

A.—If the die castings that you desire to finish are actually made from aluminum alloys then the most successful method of producing a gun metal finish would be by electroplating. Either of the following formulae can be used for the purpose.

No. 1—Water 1 gallon
Aqua ammonia 26° 4 ozs.
Molybdic acid 2 ozs.
Anodes sheet steel; voltage 4 to 6 volts.

No. 2—Water 1 gallon
Nickel chloride 6 ozs.
Ammonium chloride 6 ozs.
Sodium chloride 2 ozs.
Rochelle salts 1 oz.
Zinc chloride ¾ oz.

Dissolve all the materials in the order given in one half the water first, at 160° Fah. When all dissolved, add the balance of the water cold.

Voltage 2 to 3; anodes, nickel or sheet steel. Temperature, normal.

The cleansing of the castings is important. Cleanse in regular alkaline cleaners first; then wash in cold water, then immerse the castings in 3 parts nitric acid, 1 part water for a moment. Then re-wash in cold water and plate direct as outlined above for a few minutes; then remove, wash in cold and boiling waters, dry out and lacquer.—C. H. P., Problem 3,868.

Immersion Gold

Q.—What is a good immersion gold solution for pocketbook frames made of German silver?

A.—Formula for immersion gold solution:

Yellow Prussiate Potash C. P. 12 oz.
Carbonate soda C. P. 6 oz.
Caustic soda ¼ oz.
Gold as fulminate 3 pwt.
Water 1 gallon

Solution to be used in an iron steam jacketed kettle and must be boiled before use. When in use let solution cool to 180°F.

To replenish solution, add gold as fulminate.

Solution when made, should register 180° Be. and when less should be built up by adding a stock solution made from chemicals in the proportions used in the original formula less the gold.

—O. J. S., Problem 3,869.

Retinning Ferrules

Q.—Can you give me a process for retinning ferrules. I would like complete directions for cleaning off rust spots, preparing the tin bath, drying and tumbling, and any other procedure necessary after plating.

As you mention plating, we presume you desire a process for retinning by the electroplating method with a tin solution. The other method, by means of molten tin, is an entirely distinct process from this.

For retinning by the electro-tin process, first remove the rust with equal parts of muriatic acid and water, heated to 120 to 140° F. Then wash the ferrules in cold and boiling waters and then tumble them in the following solution with 4 to 5 volts of current to produce a bright surface:

Water	1 gallon
Soda ash	12 ozs.
Sodium cyanide, 96-98%	½ oz.

Use 4 to 5 volts in a still tank or 6 to 8 volts in a mechanical barrel.

After tumbling, wash in water and tin plate in a still solution or mechanical barrel solution heated to 120° F. Use anodes of pure Straits tin with this solution:

Water	1 gallon
Sodium stannate	12 ozs.
Sodium acetate	2 ozs.
Caustic potash	1 oz.
Sodium perborate	¼ oz.

Prepare the solution in the order given, using one-half the water first at 140 to 160°F. Plate the ferrules for 15 to 30 minutes, depending upon the thickness of tin plate desired.

After plating and thoroughly washing the ferrules may be burnished with steel burnishing balls and a neutral soap solution made as follows:

Water	1 gallon
Ivory soap chips	1 to 2 ozs.
Sodium cyanide, 96-98%	½ oz.

Instead of the direction preceding, you can substitute, if you desire, dry tumbling in a mixture of macerated leather and sawdust to which is added a small amount of precipitated carbonate of lime, or the finest of whiting.

—C. H. P., Problem 3,870.

Stove Board Finishes

Q.—We wish to add a decorative finish to some of our products similar to the effect secured on stove boards or the zinc used under stoves. Could you tell us where we can secure information for doing this work?

A.—Stove zincs such as are used under kitchen and parlor stoves are not as a rule finished in colored decorative effects. They usually have, however, embossed borders which may be made attractive by pigment colored lacquers, the highlights standing out in relief by the removal of the pigment colors by means of felt moistened with the thinners used in the lacquers. Many stove boards, in fact the majority of them, are made of ordinary sheet tin. On the surface of this is produced a crystalline or frosted effect such as appears on windows in winter. After this crystalline effect is produced, the surface is lacquered with colored tin lacquers of various shades. When dry, a felt paper is cemented to the reverse side of the tin by the aid of mineral glue (a dense solution of sodium silicate). When the glue is dry and hard, any desired embossed detail design can be produced on the surface by means of regular embossing dies and hydraulic presses. The methods are mechanical, of course, and you can work them out for your particular needs. The crystalline finish is produced on the tin by the following process:

Use bright, clean tinplate sheets. Heat the sheet to a minimum of 200°F., then apply a thin coating of the following acid mixture with a soft sponge, the operator wearing rubber gloves to avoid injury from the acid:

Water	1 gallon
Nitric acid	1½ ozs.
Sulphuric acid	15 ozs.

Fluid measure throughout.

Mix the solution thoroughly before using. This solution will produce the crystalline effect, after which the sheets should quickly be washed in cold and boiling waters, then dried out carefully, making sure not to disturb the frosted effect. Then lacquer as outlined above.

This product is sometimes lithographed in colors and when the inks are dry the unprinted parts are crystallized as here outlined, washed, dried and then lacquered with transparent or lightly colored tin lacquers.

This data should give you a good idea of how to get the results you are seeking.

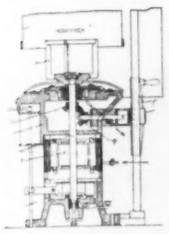
—C. H. P., Problem 3,871.

Patents

A Review of Current Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,711,389. April 30, 1929. **Centrifugal Machine for Treating Metal Articles Coated by Immersion.** Hans Hofer, Zug, Switzerland, assignor to Verzinkerei Zug A. G. Zug, Switzerland.



A centrifugal machine including a frame, a vertical shaft mounted therein, means for receiving the materials to be treated mounted on this shaft, a stationary stub shaft mounted on said frame capable of adjustment in the circumferential direction within certain limits and having an eccentric part, a wheel rotatably mounted on this eccentric part, internal teeth on the wheel, a toothed wheel mounted within the wheel and with which toothed wheel the internal teeth on the wheel can be brought into and out of engagement by a rotating movement of the stub shaft within the above mentioned limits, a shaft connecting said internal toothed wheel with a gearing which connects this shaft with the driving shaft.

1,711,603. May 7, 1929. **Process for Production of Diffused Layers on Metals.** Emil Lay, Frankfort-on-the-Main-Eschersheim, Germany.

Process for the production of diffused protective layers upon iron which comprises heating the iron with a powder composition containing from 8 to 30 per cent of free metallic aluminium.

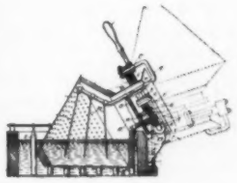
1,711,807. May 7, 1929. **Solder for Aluminum or its Alloys.** Laurence Rutherford Preston, Davenport, England.

As an article of manufacture, a solder comprising tin, zinc, aluminum, bismuth and coated with stearic acid, silver sand and phosphor tin.

1,712,244. May 7, 1929. **Process of Finishing Metal Articles and the Product Thereof.** Ernst Gideon Bek and Eugen Thoma, Pforzheim, Germany; said Thoma assignor to said Bek.

The process of producing an article having a base metal foundation and a precious metal surface inter-alloyed therewith and of predetermined composition and color which comprises coating the surface of the article with a film of precious metal having a weight less than approximately 1/40 of the weight of the article and subjecting the coated article to heat at a temperature lower than the melting point of the metal of the article and of the coating and for a time sufficient to cause inter-alloying between the precious metal of the coating and the metal of the foundation to produce a finished precious metal surface of predetermined composition and color without completely absorbing the precious metal into the metal of the article.

1,712,674. May 14, 1929. **Electroplating Apparatus.** Jose Luis Mujica, East Orange, N. J.



An electroplating apparatus comprising a stationary tank, a permeable container, a carrier for same suspended on trunnions at one side of said tank, mechanism for rotating the container, and a throat piece at one end of the container extending beyond the rotative mechanism, whereby the carrier with the container and its throat piece may be tipped on said trunnions from a receiving position in the tank to a position without the tank to discharge its contents clear of the rotating mechanism.

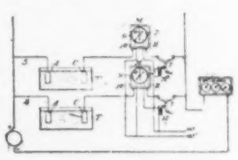
1,712,751. May 14, 1929. **Method for Cleaning Polishing Wheels and the Like.** John J. Cunningham, Dayton, Ohio, assignor of fifty-one per cent to Melrose G. Kopf, Dayton, Ohio.

The method of cleaning polishing wheels comprising an abrasive material bound together by glue consisting in treating the wheel to soften the glue and loosen the abrasive and rotating the wheel to cause the glue and abrasive to be thrown off by centrifugal force.

1,712,769. May 14, 1929. **Smelting Furnace.** Arthur Jones, Belleville, Ill., assignor to U. S. Smelting Furnace Company, Belleville, Ill., a Corporation of Illinois.

In a device of the class described, the combination with a tilting and rotating furnace, of a fuel supply pipe for said furnace extending in the direction of the length of the furnace, a lateral extension carried by said supply pipe, a burner carried on said lateral extension, and means for rotating said pipe on its axis to throw said burner into and out of alignment with the furnace.

1,712,284. May 7, 1929. **Method and Apparatus for Electro-Deposition.** Lawrence C. Turnock, Edgewood, Pa.



In an electro-plating system, the combination of an electro-plating bath, an anode and a cathode therein, a source of electromotive force connected to the anode, and a meter for indicating the amount of metal deposited at the cathode in accordance with the current traversing the cathode, of electrically operated means for interrupting the electrical circuit including the bath after a predetermined amount of metal has been deposited, the circuit interrupting means being so connected to the meter that the indications of the meter are not influenced by the electrical currents actuating the interrupting means.

1,712,988. May 14, 1929. **Treatment of Light-Metal Alloys.** John A. Gann, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich.

In a method of treating a light metal alloy in which magnesium is the predominant constituent, said alloy also containing approximately eight per cent of aluminum, the step which consists in heating a casting composed of such alloy at from 800° to 820° Fahr. for approximately one hour.

1,712,989. May 14, 1929. **Treatment of Light Metal Alloys.** John A. Gann, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich.

In the art of making alloy articles having magnesium as the predominant constituent and also containing as a minor constituent a metal normally forming both a eutectic and a solid solution with the magnesium, the step which consists in subjecting such article to a heat treatment at a high temperature, but below the melting point of such eutectic, to cause substantially complete solution of the latter.

1,712,990. May 14, 1929. **Treatment of Magnesium-Base Alloys.** John A. Gann, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich.

In the art of making light metal alloy articles wherein magnesium is the predominant constituent, the alloy containing as minor constituents two other metals capable of forming eutectics differing as to their melting points, and also as to ease with which they dissolve in the magnesium to form a solid solution, the steps which consist in heating such an article at a high temperature but below the melting point of the more fusible eutectic, to cause substantially complete solution thereof, and then heating such article at a higher temperature but below the melting point of the less fusible eutectic to cause increased solution thereof.

1,713,093. May 14, 1929. **Heat Treatment of Aluminum Castings.** Randolph J. Roshirt, Detroit, Mich., assignor to Bohn Aluminum & Brass Corporation, Detroit, Mich.

The process of heat treating aluminum alloys, comprising heating the alloy to a temperature as high as possible without distortion of the same, quenching from said heat and reheating at a temperature from 425° to 475° F.

Equipment

New and Useful Devices, Machinery and Supplies of Interest

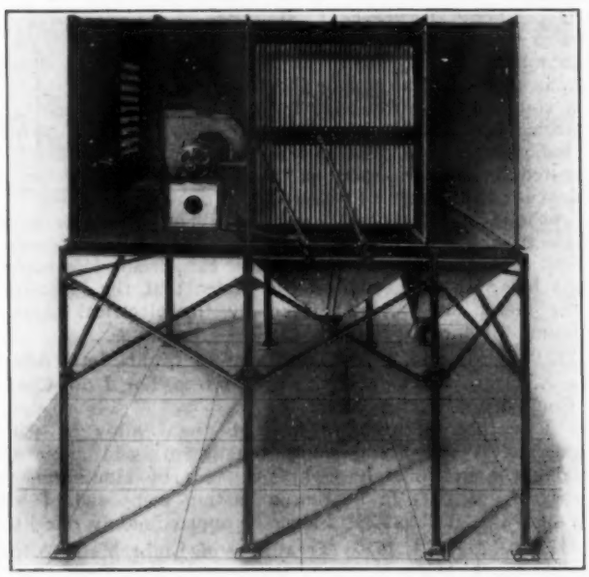
Taking the Dust Out of Industry

By R. J. HUTCHINSON

The American Foundry Equipment Company, Mishawaka, Ind.

The evils entailed by the dust nuisance in manufacturing processes are too well known to require more than passing mention: slowing down production, impairing health, wearing out machinery, lowering efficiency generally. Dust and its suppression are today engaging the best engineering minds in the country.

A dust arrester is simply a metal house, divided into two sections by a screen of cloth. In its elementary form, it would



Cloth Screen Dust Arrester with New Rapping Device

be a hollow cube, with one plain cloth screen sealed to the side walls, ceiling and floor, midway between the ends of the box. The greatest possible cloth area in a minimum cubic foot space is attained by a staggered effect, stretching parallel cloth surfaces over a frame so that they will be separated by an inch or so, and hanging the screens parallel to each other so that they project outward like the fingers of a hand.

On one side of the screens, the dust laden air enters the arrester under suction from the fan. Much of the heavier dust falls into the hopper of its own weight, as soon as the velocity of the inrushing air is lowered on entering the larger expansion chamber. Incoming air is thus dropped from an average velocity of, say 4,000 feet per minute, to a velocity of only a few feet a minute, no longer sufficient to support heavy dust.

On the other side of the screens is the "clean air side" from which the clean air goes directly through the fan and is discharged back into the building, saving a large item in coal.

Departing from the hit-and-miss practices prevalent until a few years ago, engineers now figure arresters on a scientific basis which assures the velocity of air passing through the cloth to be not more than three or four feet per minute. This creates no actual pull of any consequence, so that dust particles in the air adhere to the fibers of the cloth and are strained from the air as it passes through the pores.

Naturally, in order to prevent the fibers of the cloth becoming overloaded, plugging the pores, and setting up a prohibitive suction to get the air through the cloth, it is necessary to dislodge all accumulated dust at regular periods during the day's operation. This is accomplished by mechanical or pneumatic vibrators, preferably the former, the object being to strike the edge of each suspended screen a smart blow, imparting a uniform vibration to the entire cloth surface by means of stay wires attached to the frame, and whipping or beating out all particles of dust so that they are dislodged and fall into the hopper. Naturally, it is necessary to shut off the fan while this is being done, as otherwise the dislodged dust would be sucked through the cloth.

Many types of vibrating mechanism have been employed, all developing some inherent weaknesses which have caused engineers constantly to search for the ideal method of vibration. The American Foundry Equipment Company has recently brought out a new and apparently much superior device known as the Ball Rapper, which functions on a principle entirely new.

The improved rapping or vibratory device which is an important part of American arresters, insures the entire cloth covering of every screen being thoroughly freed from dust without injury to either the screen frame or the cloth.

The rapper consists of an electrically driven arm, tipped with a hardened steel ball. The bank of screen across which the ball rapper passes is equipped with steel shoes on the edges to receive the blow. Each screen is struck a positive rap which dislodges all dust.

This method of rapping has proved itself far superior to previous types such as pneumatic or electric hammer for two reasons. First, it treats each screen individually, eliminating the former slow destruction of screen frames through too severe shaking and plugging of the cloth through insufficient vibration, which were the most notable drawbacks of the two previous types.

In addition, and besides insuring against the sticking prevalent with pneumatic types in cold weather, when freezing of moisture in the air line is an element to be considered, it insures screens at the ends of the bank being just as efficiently rapped as those in the middle, with a consequent longer period between recovering the screen frames.

The construction of the new style rapping device is shown on the photograph. At the right is a settling chamber, to drop velocity and precipitate coarse abrasive particles before the air passes to the screen chamber. Screens are suspended as shown in the middle section, the motor driving the ball rapper being attached outside the casing. At the left is a fan house, enabling the exhaust fan to be placed in its most advantageous position directly outside the arrester shell.

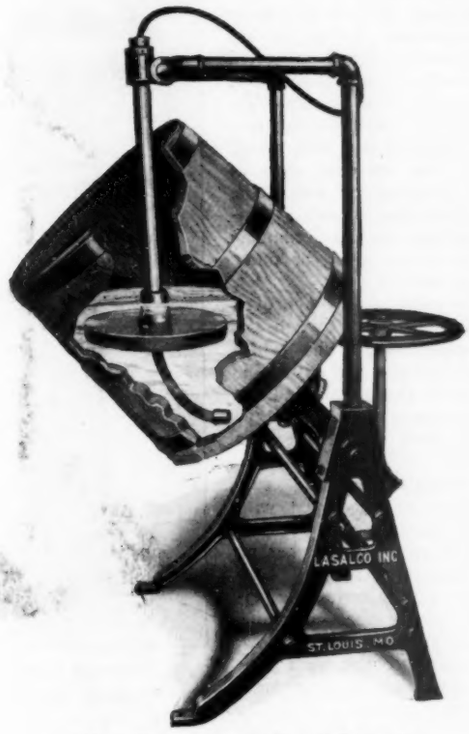
It is interesting to note that the heat lost by a small system, exhausting only 5,000 cubic feet of air a minute into the outside atmosphere, is, in freezing weather, equivalent to using 1½ tons of coal per month. Arranged to discharge inside the building, a cloth screen arrester provides clean air with no heat loss—a saving in overhead and an improvement in working conditions within the plant.

Factory Floors

A new type of flooring called Kabalt is being made by Dyer, Inc., 796 Tenth avenue, New York, with factory at Rutherford, N. J. This is a mastic floor consisting of an asphalt base strengthened by a cement ingredient. It can be furnished in special compositions to resist acids or alkalies. Patches of this material can be laid on a Saturday and be ready for use on the following Monday. It is claimed to be resistant to hard knocks, and when dented, to come back to its original smoothness.

Improved Tilting Plating Barrel

A new type of mechanical electroplating barrel, embodying certain novel features, has been designed and introduced on the market by Lasalco, Inc., 2822-38 Lasalle street, St. Louis, Mo., widely known manufacturers of electroplating and polishing equipment and supplies. The new mechanism, which is known as the "Bull's-Eye Plating Barrel," is claimed to have the unique propensity of



New Type Tilting Plating Barrel

plating the load without plating the inside of the barrel. The company states that this is made possible through the use of Lasalco patented "Bull's-Eye" anode, with center negative conductor.

The manufacturer states that if a plating barrel of any type has negative connections attached and fastened to the barrel, these conductors must periodically be removed and cleaned to prevent the plated deposit from treeing out and spreading to adjacent parts. Such spreading of the deposit, it is claimed, is likely to continue and cause most of the deposit to be applied to the barrel rather than the load, obviously necessitating longer time of operation to produce an adequate deposit on the work. In this respect, it is stated, the oblique barrel can now be operated without fear of spreading.

In the new type of apparatus offered, the circle-grooved anode is suspended horizontally over the cathodes. The insulated negative conductor is conveyed directly through the center of the anode to the cathodes. The arrangement is shown in the illustration, where a portion of the barrel has been cut away to show the anode and negative conductor.

Dimensions of the barrel, inside, are 21 in. diameter at top, 24 in. at bottom; depth, 21 in. Weight, with belt drive, approximately 600 lbs.; requires 4 by 5 ft. floor space. With motor drive, weight is about 700 lbs. and same floor space is required. Standard belt drive has tight and loose pulleys, 16 by 3 in. For motor drive, one-half horsepower motors of desired current are supplied.

New Metal Flux

The Aelium Company, 832 No. Spring street, Los Angeles, Calif., has placed on the market a material said to be a natural cleanser of metals. It is recommended by them for high lead bronzes, to keep the lead suspended, and for other standard brasses and bronzes, to result in more homogeneous mixes, better machining qualities, better polishing qualities and closer grained metal; also for manganese bronze to cut down the shrinkage and eliminate porosity.

This material is recommended also for a number of other alloys in mixtures depending upon the composition used.

Metallographic Polishing Machine

The Warner and Swasey Company, manufacturers of optical instruments, are the makers of a metallographic polishing machine known by their name, which is distributed by The Chemical Rubber Company, Cleveland, Ohio, who have issued a description of the machine.

It is stated that the machine, developed originally by Warner and Swasey for their own use, found favor with others who needed such an apparatus and the demand grew so that commercial production of the machines was decided upon. They are stated to be made by the skilled mechanics of the optical instrument concern, accustomed to producing apparatus of highest accuracy. The polishing machine is used for preparing metallic specimens for microscopic and micrographic examination. It is said to embody the advantages of speed and ease, having been designed by a metallurgist and built with great care. The chief features are summarized as follows:

Each of four bronze polishing plates is constructed so that its speed may be varied from 285 to 1525 r. p. m., independent of the other plates. Bronze bearings are used throughout, and one 80 grain grinding wheel is furnished with the machine which has a solid oak table. The polishing plates are enclosed in an aluminum bowl which prevents the splashing of grinding powders from one wheel to another. There is also an aluminum cover to protect each plate from dust and dirt when it is not in use. The whole outfit comes completely equipped with a motor and set up ready for operation.

The machine is said to operate quietly and to be of desirable appearance as laboratory apparatus. Among the users in the nonferrous metal field, the company lists the Ohio Brass Company, Western Cartridge Company, Taunton-New Bedford Copper Company, General Electric Company and many others.

Nickel Clad Steel Pots

A new type of melting pot has been developed, according to an article in Inco, Volume 9, Number 1, page 10, published by the International Nickel Company of New York, entitled "Nickel Clad Steel Eliminates Costly Pot Failures," by G. R. Greenslade.

Dr. Greenslade announces the development of a pot of low carbon steel or iron ingot form, drawn from solid sheet. The outside is clad with nickel by metallic arc welding. The steel on the inside of the pot is capable of resisting the lead or other constituents of the bath while the nickel on the outside resists the action of air and combustion gases at high temperature. Due to the strength and ductibility of the metals used, a relatively thin wall is sufficient, as there is no danger of failure by cracking. It is, therefore, necessary to use Niclad pots having a thickness of only ½ inch. This results in better heat conductivity and almost negligible drop in temperature. The two metals are said to be very well suited for joining since their coefficients of thermal expansion are about the same and there is no tendency to force the two metals apart when they are heated up to high temperatures.

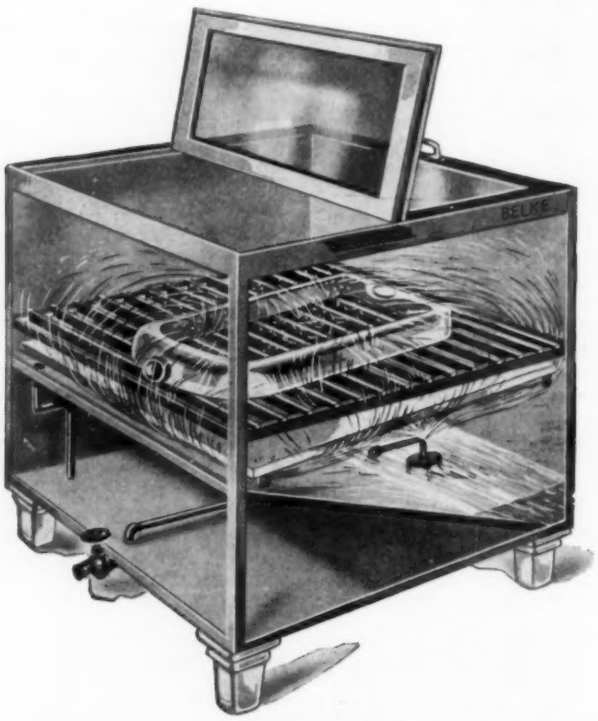
An inner surface of steel resists corrosive action in the pot and a non-oxidizing outer coat of nickel affords protection against hot furnace gases

Tests are cited which show an average length of 7,000 hours for Niclad compared with 300 hours for plain steel and 1,000 hours for special heat resisting alloys.

New Salt Spray Tester

The value of plating cannot always be gauged by sight, and without careful tests of different batches of the product as it goes through the manufacturers take a serious and unwarranted risk. Plating may look all right from the outside, but the imperfections soon show up. Many jobs have to be done over at a great loss in labor wasted, materials and good will in every such instance. These hazards can be overcome—at least to a great extent—by salt spray tests.

The Belke Manufacturing Company of Chicago, which has carefully studied salt spray testing equipment for several years, and which has a testing machine in wide use on the market has recently announced a new and larger testing equipment which is said to be built along entirely new lines. This unit is a square tank of white enameled steel, with Monel trimmings and glass top, mounted on legs. It is equipped with a sloping drain and glass rack for articles to be tested. It is gas tight and adapted to testing plating of various kinds. This new machine is said to be based on the same general principles which have characterized the other unit.



Salt Spray Tester

The Bureau of Standards, commenting on the Salt Spray test have found: "Although the salt spray test is subject to objections, it may be regarded as the best test for zinc coatings. A sample showing rust spots in 24 hours should be set aside as unsatisfactory, while a sample that would withstand two or three days could be relied on as to the plating. Any test which will effectively show the presence, number and approximate size of breaks or pinholes in a comparatively short time (usually 3 to 10 hours) may be used to include in a general way the quality of the coat applied.

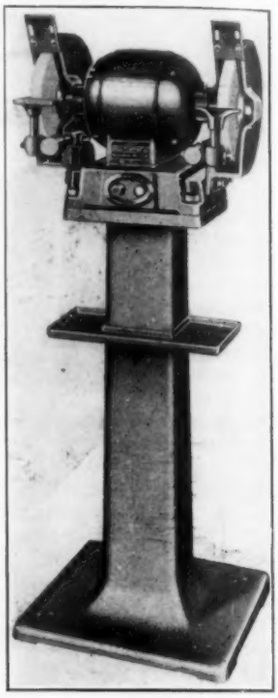
Aside from what is claimed to be the highly efficient design of this Belke product for testing purposes, its appearance is attractive, giving the whole equipment a clean, white effect.

Pressure Tanks

The Paasche Airbrush Company, 1909 Diversey Parkway, Chicago, Ill., is manufacturing a line of stationary pressure tanks for large finishing production. These tanks, called "Clamptight," are said to be fast operating, with no nuts or bolts to tighten or wrenches necessary. Simply turn the levers over and the cover is on or off quickly. Each clamp is adjustable with washer shims for proper tension, and once set, tightens uniformly. They are one-piece pressed steel tanks and consequently easy to clean.

New Grinding Machines

Below is a photograph illustrating the new 6-inch and 8-inch electrically driven grinding machines, which are made by Hill-Curtis Company, Kalamazoo, Mich. This machine is made in the bench and pedestal type. It is made for both alternating and direct current for any standard motor specifications. High-grade, oversize ball bearings are mounted in the end head in close proximity to the wheels and all bearings are completely enclosed and protected from dust and grit. This machine, like all Hill-Curtis electrically-driven grinding and polishing machines, is enclosed and dust proof, having no holes or open slots in the motor housing or end bells, thereby eliminating possible danger to windings by the accumulation of emery grit, dust, or other particles of dirt.



Pedestal Type Electric Grinder

Two-pole underwriters' approved quick-make-and-break switch is standard equipment. The wheel guards and tool rest are adjustable to the wear of the wheels and can be quickly removed when the type of operation does not permit their use.

Single phase, alternating current, machines are equipped with improved commutating type repulsion-induction motor, which has no dragging centrifugal switch. Low voltage has no objectionable effect on this single phase machine. Starting current is unusually low, thereby making it the ideal machine for attaching to convenient lighting circuit outlet.

Motors in all Hill-Curtis electrically-driven grinding and polishing machines are enclosed and dust proof, guaranteed to develop name plate horse power rating and are liberally proportioned to withstand momentary overload of 100 per cent beyond rated capacity.

Lever Punch

The Excelsior Tool and Machine Company, East St. Louis, Ill., has made an addition to its line of punching tools in its ball bearing lever punch No. 19. This punch is useful on erecting or assembling floors where metal parts are fit and punched or drilled. Some of the advantages are as follows:

Lever Punch

Ball bearings on eccentric and main shaft.

Stand with forward protruding legs so that the machine cannot tip when punching.

Balanced lever so that the handle is always in upright position.

Stripper does not obstruct the view of the punch.

Front and side gauges are adjustable to requirements.

The slide is square with provision to take up the wear so that the most delicate odd shape punches and dies can be used without injury.

Pinhole Detector

A simple test paper has been developed for detecting the presence of pinholes in protective coatings whereby tests can be made quickly and without injuring the test piece. The Fisher Scientific Company, Pittsburgh, Pa., has placed on the market Ferracco test paper. This comes in sheets 22 in. x 17 in., coated with a mixture of potassium ferrocyanide, sodium chloride and gelatine, in certain proportions. When the exposed metal comes in contact with this sensitized paper, a colored complex dark blue cyanide is formed which indicates the position and the size of the pinhole. The blue spots indicate pinholes down to an iron base, while brown spots indicate those to a copper or brass base.

Ferracco Record of Pinholes in Tinplate

Demonstrated Use in a Tin Plate Laboratory

The head of the laboratory procured a test piece of tin plate two feet square. It was an average-looking sheet, that to the eye showed no pinholes. All possible grease and dirt was cleaned off, using a cotton swab dipped in benzol. A sheet of Ferracco paper smaller in size than the sample was thoroughly moistened with distilled water and firmly and evenly pressed against the tin-plated surface.

The blue spots that indicate the position of the pinholes began to show in about five to ten minutes, even through the reverse side of the test paper. The paper was allowed to remain twenty minutes when it was removed and thoroughly washed and dried. This sheet of test paper then became a permanent record of the test.

Testing of Nickel and Chromium Platings

With slight variations in the manipulation of the test paper, other protective coatings are tested for pinholes. In chromium and nickel plating on copper and brass, it was found best to moisten the paper with a solution of ammonium citrate and ammonium carbonate instead of distilled water. When the base metal is iron or steel, distilled water alone should be used, otherwise the blue stain wil be retarded in its formation.

To test over-buffed plating, i. e., plating where excessive buffing has thinned the plate almost to the base, Ferracco paper plainly shows areas of light brown or blue.

Another use for this test paper is the detection of minute holes in thin metal foil. The foil is laid on an iron plate and the paper used as in the tin plate test. Blue spots will show the location of pinholes in the foil.

Ferracco pinhole test paper is claimed to be simple to manipulate, saves time and material and leaves a permanent record for research files and production control data.

Lubricating Equipment

The Dot Lubricating Equipment Company, a division of the Carr Fastener Company, Cambridge, Mass., manufactures a line of lubricating equipments, lubricants and other supplies and apparatus for the lubrication of machinery, vehicles and other uses. The company has designed and placed on the market a special type of apparatus for the lubrication of plant machinery, tractor, farm vehicles, and other equipment used for heavy service where bearings are subjected to severe strains and considerable dust, dirt or other matter that might tend to adulterate the lubricants used. This outfit, known as the "Nozzle-Fil" equipment, consists chiefly of a barrel pump for drawing the lubricant from the

Barrel Pump, Hand Pump and Hand Filling Tank for Lubrication

drums or barrels in which it is stored, a filling tank into which the lubricant is transferred for carrying to the machinery or vehicle to be lubricated, and a gun for the actual work of lubricating. These three pieces of equipment are shown in the illustration. Other equipment such as pressure cups for attachment to machinery or vehicles, nipples of various angles by means of which the "Nozzle-Fil" gun is applied, and the lubricant are also supplied by the Dot company.

Describing the use of the "Nozzle-Fil" equipment, the makers state that the barrel pump is attached to the drum of lubricant. By its use, the hand filling tank which the operator can carry is filled with lubricant without danger of dirt or grit getting into it to injure bearings. After the tank is filled at the barrel, the operator carries it to the equipment to be lubricated, where he sets it down. He then takes the hand filling pump and fills it from the filling tank by means of a pump on the small tank. He then attaches the gun to nipples or pressure cups on the vehicles or machinery he is lubricating and proceeds to force the proper amount of lubricant into the bearings by twisting the handle of the gun.

It is pointed out that the grease throughout the operation—from drum to bearing—is not exposed to the air for more than a few seconds, which, the makers claim, eliminates all danger of dirt or grit entering it.

Equipment and Supply Catalogs

Uehling Barometer and Vacuum Recorder for Steam Turbines. Uehling Instrument Company, Paterson, N. J.

Heat Treating 100 Jobs at a Stroke. The Brown Instrument Company, Philadelphia, Pa. Broadside on installation of control instruments.

Allen Air Appliance Company, 452 Lexington Avenue, New York City. Bulletin A-50, covering compressors, exhausters, vacuum cleaning equipment, etc.

Round Form Recorders. C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y. Broadside on precision indicating, recording and controlling instruments.

Metalayer, the Putting-on Tool. Metals Coating Company

of America, Philadelphia, Pa. Leaflet on a tool for spraying molten metals for surfacing and building up.

Certified Selling. A. C. Nielsen Company, Chicago, Ill. No. 7 of the company's monthly magazine. One dollar a year to all except subscribers to the company's surveys.

The Mond Nickel Bulletin. American Mond Nickel Company, Century Building, Pittsburgh, Pa. The May, 1929, issue contains a summary of current information on nickel. Valuable abstracts and references are given.

Thermo-Elements. Charles Engelhard, Inc., 30 Church Street, New York. Platinum and platinum-rhodium elements, rare metal and base metal types, are discussed, with regard to the reclamation of elements in the replacement of thermo-couples.

Roots Covers Industry Like a Blanket. The P. H. and F. M. Roots Company, Connersville, Ind. Bulletin 10-B1, catalog of pumps, blowers and other equipment. Also, No. 22-B1 on low pressure blowers with roller bearings; No. 1181, engineering tables.

Nielsen Survey Index—June, 1929. A. C. Nielsen Company, Chicago, Ill. The following surveys, ordinarily offered only to subscribers of the Nielsen company, will be sent free upon request: Hack Saw Blade Sharpener; Magnet Crane for Pig and Scrap Handling; Standard Metal Reclaiming Mill for Preparing Copper Alloy Skimmings for Smelting, used by Buffalo Metal Reclaiming Mill. The surveys are made to determine the economy of various types of equipment.

General Electric Company, Schenectady, N. Y., publications. Helicoil Sheath-Wire Immersion Heaters; Travel Carriage for Automatic Arc Welders; Two-Stage Reciprocating Air Compressors; Reciprocating Air-Compressor Sets, Two-Stage, Stationary; Continental Gas-Engine Driven Arc Welder; Reciprocating Air-Compressor Sets, Single-Stage, Stationary; Reciprocating Air Compressor Sets, Single-Stage, Portable; Motor Drive for Metal Working Machinery (32 pages, illustrated); G-E Arc Welding School (8 pages, illustrated); Industrial Heating Devices; Type WD-300A Arc Welder; Type WD-200A Arc Welder; Induction Motor-Generator Sets.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

American Electroplaters' Association

HEADQUARTERS, CARE OF GEORGE GEHLING, 5001 EDMUND STREET, PHILADELPHIA, PA.

Los Angeles Branch (Temporary)

HEADQUARTERS, CARE OF M. D. RYNKOFS, 1354 WEST 25th STREET, LOS ANGELES, CALIFORNIA

June Meeting

The temporary Los Angeles Branch held its monthly meeting June 12, 1929, at the Central Y. M. C. A., Los Angeles, with twenty-four members present. After a good dinner and a short business session, a technical session was held, with Librarian Charles Russell presiding. The Question Box brought out discussion on the following questions:

How to Copper Plate Aluminum Without Preliminary Nickel Plating.

Methods of Gold Plating and Solution Maintenance.

Treatment of Cyanide Sores.

Anodes for Chromium Plating.

Control of Arsenic Content in Brass Solutions.

Method of Producing Statuary Bronze Finish Directly on Brass Without Preliminary Copper Plating.

Formula for Verde Green (Dark) Solution.

At the next meeting the subject of chromium plating on aluminum will be discussed. The meeting will be held on July 10, at 6:15 p. m., at Central Y. M. C. A., Los Angeles. Platers and others interested are urged to attend.

M. D. RYNKOFS, Secretary.

New York Branch

HEADQUARTERS, CARE OF R. J. LIQUORI, 2439 HUBBARD STREET, BROOKLYN, NEW YORK

New Officers Installed

The New York Branch, American Electroplaters' Society, held a meeting at its regular meeting room, 611 World Building, Park Row, New York City, June 14, 1929, at which the following were installed as officers for the 1929-1930 year, Past-President Thomas Haddow presiding:

Fred Haushalter, president; Ralph Liquori (formerly secretary), vice-president; John Sterling, secretary-treasurer; Charles Haushalter, recording secretary; Henry Levine, librarian; Ben Nadel, sergeant-at-arms; Elias Schorr, assistant sergeant-at-arms. The following trustees were named: A. Havens, J. Rolff, Frank MacStoker. Delegates to the Detroit convention will be: Frank MacStoker, Fred Haushalter and John Sterling.

CHARLES HAUSHALTER, Recording Secretary.

National Metal Congress

HEADQUARTERS, 7016 EUCLID AVENUE, CLEVELAND, OHIO

America's first annual Metals Congress, to bring together leaders in the metals industries and those who will be the leaders, is to be held in Cleveland, Ohio, September 9 to 13, 1929. The National Metals Congress is, to a considerable extent, an outgrowth of the great conventions and expositions held by the American Society for Steel Treating with whom several other organizations have joined in late years. It opens in Cleveland simultaneously with the eleventh annual convention and exposition of this society and in the home city of the society's present president, Dr. Zay Jeffries, and its secretary, W. H. Eisenman. Coincidental will be the national fall meeting of the American Welding Society, the national fall meeting of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, the national fall meeting of the Iron and Steel Division of the American Society of Mechanical Engineers and the national fall meeting of the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers.

In addition to the metals congress, there will be assembled in Cleveland's big public auditorium the eleventh annual metal exposition in which will be displayed the most modern types of metal working machinery and equipment. Demonstrations of the various devices aimed to improve conditions in the processing of metals will be given. Floor plans for exhibit space have been ready for some time and already over 200 exhibitors have subscribed for display space.

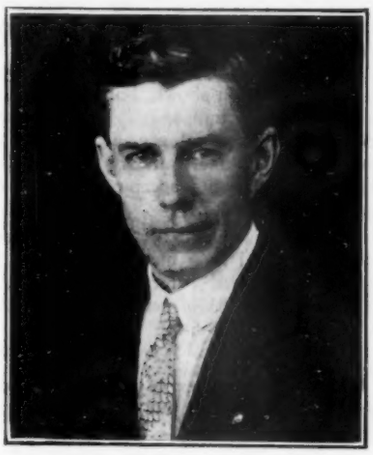
The program for the National Metal Congress is rapidly being prepared. All of the five National Societies holding simultaneous conventions during that week have practically completed the selection of papers for the event, but the arrangement of them is to be given final consideration at a meeting to be held at Atlantic City on Thursday, June 27th, where endeavor will be made to arrange the papers so as to avoid conflict of interests. Those who will attend the meeting for the definite arrangement of the papers representing the Institute of Metals Division, are: Sam Tour, chairman of program committee; S. Skowronski, chairman of Institute; W. M. Corse, secretary of Institute.

Personals

Oliver J. Sizelove

Oliver J. Sizelove, head of the plating and finishing department of the August Goertz Company, Newark, N. J., has been appointed an associate editor of THE METAL INDUSTRY, in charge of testing and analytical work on plating solutions.

Mr. Sizelove's experience in the polishing and plating departments of numerous plants may be classified in two parts, East and West. Born on a farm in Butler County, Ohio, April 9, 1880, his early schooling took place in a country school. At the age of 18, having attended both elementary and high schools, he decided to go to work. As early as the first job, Mr. Sizelove has been associated with the polishing, plating and finishing of metals. During his first job, apprenticeship was served in the polishing and plating departments of the Estate Stove Company, Hamilton, O. His polishing experience ranged from cast iron stove parts to sewing machine parts, which were made of the finest steel. The last five years of the thirteen spent in the West were served as foreman of the polishing and plating departments of Fred J. Meyer Manufacturing Company, Hamilton, O., and Felker-Mieth Company, Dayton, O.



Oliver J. Sizelove

The experience obtained in the plating departments of the various companies in the West made it clear to Mr. Sizelove that in order to be successful with plating solutions, it was necessary for one to have a knowledge of chemistry. Securing a position as foreman plater and polisher with the Bonny-Veslage Tool Company, Newark, N. J., he immediately enrolled at the Newark Technical School, where he specialized in chemistry for five years.

Having as a background the education and practical experience as foreman polisher and plater with many companies for the previous eighteen years, Mr. Sizelove decided to go into business for himself. He was a partner in the Merigold Plating Company. This gave him one and one-half years' experience in the job plating line. The following year was spent at the J. K. Osborne Manufacturing Company, Harrison, N. J., makers of novelties. The Elite Novelty Company of Newark, manufacturers of soft metals furnished another opportunity for Mr. Sizelove's experiences. For the past seven years Mr. Sizelove has been connected with the August Goertz Company, Newark, manufacturers of metal novelties, as foreman plater, having charge of the finishing department, which includes polishing, plating, finishing, lacquering and inspecting.

Mr. Sizelove has been associated with the American Electroplaters' Society of Newark since 1914. He is well known for his participation in educational activities of the Society. In 1926, he received first award for submitting the best paper of the year to the Society. The paper contained simplified methods for control of plating solutions, which was later published in THE METAL INDUSTRY. Mr. Sizelove's aim has always been to help the plater.

With the cooperation and permission of the Essex County Vocational School Board, Mr. Sizelove has formed a course of study known as Chemistry of Plating for the benefit of the members of the Society and all foreman electroplaters. Four years have been spent at the Newark Boys' Vocational School teaching Chemistry of Plating.

T. O. Koopman, formerly general superintendent, has assumed the duties of manager of the plant of the National Lead Company at Matawan, N. J.

N. T. Dyett has been elected president of the General Cable Corporation, succeeding **Walter Robbins,** who was elected chairman of the board to succeed **J. W. Marsh,** who has resigned and has been elected vice-chairman.

Hugh D. McLeese has been appointed resident sales manager at Detroit, Mich., for United Chromium, Inc., 51 East 42nd Street, New York City. Mr. McLeese maintains headquarters at 3220 Bellevue Avenue, Detroit.

F. B. Danehower has been elected president of the Ross-Tacony Crucible Company, Philadelphia, Pa., to succeed the late Henry A. Ross. He was formerly vice-president and treasurer and still retains the office of treasurer. **Charles C. Bacon** continues as secretary of the company, and **Walter L. Ross, Jr.,** has been elected vice-president and assistant treasurer.

A. W. Mackay, connected with the firm of Wright, Boag and Company, general engineers, iron and brass founders, Johannesburg, South Africa, is visiting various plants in the United States to study American foundry methods and equipment. Besides the United States, Mr. Mackay has visited foundries in Holland, Italy, Bavaria, Germany, Austria, Czechoslovakia, Hungary and England.

R. L. Cathcart has opened offices at 2247 Oliver Building, Pittsburgh, Pa., where he will act as exclusive agent on tin for Metal Traders, Inc., New York City, and also conduct a brokerage business in slab-zinc, lead, antimony, cadmium and other metals. Mr. Cathcart formerly was district sales manager at Pittsburgh for the New Jersey Zinc Sales Company, New York City, and, for the past three years, has been vice-president of the E. E. Zimmerman Company, Pittsburgh.

Obituaries

Dwight M. Houston

Dwight M. Houston, foundry engineer in the research and development department of the International Nickel Company of New York, died of heart failure on April 28, 1929, at his home in Indianapolis, Ind. He was 52 years old. Mr. Houston was a graduate of Miami University, Ohio, and previous to his identification with the nickel company had been with the Nordyte Marmon Company, Indianapolis. He was active in research in the application of nickel to cast iron, and was a member of the American Foundrymen's Association and the American Society for Steel Treating.

D. T. Homan

D. T. Homan, vice-president of the Bridgeport Safety Emery Wheel Company, Bridgeport, Conn., died recently. Mr. Homan was born June 3, 1846, near Yaphank, Long Island, N. Y. After graduating from Eastman College, Poughkeepsie, N. Y., he entered the selling field. He became associated with E. R. Hyde of Springfield, Mass., in the Springfield Glue and Emery Company, which later removed to Bridgeport. When the Bridgeport Safety Emery Wheel Company was formed, he continued as vice-president, taking charge of sales activities, while Mr. Hyde became the president.

News of the Industry

Industrial and Financial Events

Chase Companies, Inc.

Further information regarding the acquisition of the Chase Companies, Inc., Waterbury, Conn., by the Kennecott Copper Corporation states that the merger was effected by the exchange of stock on the basis of 2¼ shares of Kennecott Copper stock for each share of the Chase Companies stock. As there are outstanding 112,500 shares of Chase stock, the consummation of the deal calls for the issue of 253,125 additional shares of Kennecott Copper stock, which brings the total outstanding up to 9,632,998 shares.

Application has been made by the Kennecott Copper Corporation to list the additional capital stock issued for the purpose of that exchange. In that application the corporation submits a report of the Chase Companies for the three years 1926, 1927 and 1928 respectively, and also for the first four months of 1929. The report shows that the Chase Companies earned $8.06 a share in 1926, $8.13 a share in 1927 and $14.08 a share in 1928, after depreciation, taxes and other charges. The net income for the first four months of the current year was $982,351, equivalent after depreciation to $8.73 a share. That compares with net income for the full year of 1928 of $1,584,357.

The consolidated balance sheet of the Chase Companies, Inc., as of May 1, 1929, shows total assets of $29,957,408, and surplus of $10,142,965. The company held $1,589,933 cash, had call loans outstanding of $2,000,000 and has marketable securities of $122,260 as of that date.

The Chase Companies, Inc., the statement shows, is a holding and operating company, organized in 1909. It owns 100 per cent of the issued and outstanding shares of the Chase Brass and Copper Company, Inc.; American Brass and Copper Company, the Consolidated Safety Pin Company and the Noera Manufacturing Company. It also owns approximately two-thirds of the capital stock of the Superior Wire Cloth Company and 50 per cent of the capital stock of the Hallenbeck-Hungerford Realty Corporation. The Chase Brass and Copper Company has outstanding in the hands of the public 25,000 shares of 6 per cent cumulative preferred stock of $100 par value a share, the principal and interest of which is guaranteed by the parent company.

The Chase Companies operates two brass mills and a brass fabricating plant in Waterbury, Conn., employing approximately 4,400 men and producing more than 600,000 pounds of brass and copper products a day.

The Chase Brass and Copper Company, an Ohio corporation, located in Euclid, Cleveland, Ohio, has in process of erection a brass manufacturing mill, about 50 per cent completed, which will be capable of producing approximately 200,000 pounds of brass and copper products a day when completed.

poration, is engaged in marketing brass and copper products. It

The Chase Brass and Copper Company, Inc., a New York corporation, is engaged in warehousing and merchandising copper and brass products, reaching a slightly different trade from the Chase Copper and Brass Company, according to the statement.

operates warehouses in thirteen cities, located in various parts of the United States, including New York, Philadelphia, Boston and Chicago.

The American Brass and Copper Company, a New York corporation, is engaged in warehousing and merchandising copper and brass products, reaching a slightly different trade from the Chase Copper and Brass Company, according to the statement.

The Consolidated Safety Pin Company, a New Jersey corporation, manufactures safety pins, vanity cases and other miscellaneous brass articles. The Noera Manufacturing Company, a Connecticut corporation, is located at Waterbury, and is engaged in manufacturing oilers, tire pumps and other small pumps. The Superior Wire Cloth Company, a Pennsylvania corporation, is located at Hungerford, Pa. It makes bronze and brass wire cloths. The Hallenbeck-Hungerford Realty Corporation holds real estate in New York at 80 Lafayette street.

The Chase Companies, Inc., has no funded debt but has guaranteed $2,712,000 bonds of the U. T. Hungerford Brass and Copper Company, the assets of which were acquired by a subsidiary in 1927.

Ingot Brass and Bronze

Non-Ferrous Ingot Metal Institute headquarters, Chicago, Ill., reports the average prices per pound received by its membership on commercial grades of the six principal mixtures of Ingot Brass during the twenty-eight day period ending June 21, 1929. As there are, as yet, no generally accepted specifications for ingot brass, it must be understood that each item listed below is a compilation representing numerous sales of metal known to the trade by the designation shown, but each item, in reality, including many variations in formulas, it is stated. Until the program of standardizing the principal specifications, now progressing in cooperation with the American Society for Testing Materials, is completed, the following specifications will be understood to refer to "commercial grades."

Commercial 80-10-10 (1% impurities)	17.309c
Commercial 78% metal	15.45c
Commercial 81% metal	15.616c
Commercial 83% metal	16.024c
Commercial 85-5-5-5	16.331c
Commercial No. 1 yellow brass ingot	13.515c

Combined deliveries of brass and bronze ingots and billets by members of the Institute during the month of May, 1929, were 9,646 tons.

On June 1st the unfilled orders for brass and bronze ingots and billets on the books of the members of the Institute amounted to a total of 13,339 net tons.

Abrasives Export Combine Formed

The Durex Abrasives Corporation has been formed by a number of abrasives manufacturers for the purpose of combining in export business in their line. The corporation includes nine companies in the abrasives field, with annual export sales of several million dollars, who have individually withdrawn from the export field as far as their sandpaper products are concerned, and have combined under the Webb-Pomerene Act for the conduct of their export business. These companies are the American Glue Company, Armour and Company, Baeder-Adamson Company, H. H. Barton and Sons Company, Behr-Manning Corporation, The Carborundum Company, Minnesota Mining and Manufacturing Company, United States Sandpaper Company, and The Wausau Abrasives Company.

The corporation's head office is located at 70 Montgomery Street, Jersey City, N. J., and an operating office is maintained at 82 Beaver Street, New York.

Parker Rust-Proof Company

The Parker Rust-Proof Company, Detroit, Mich., has merged with the Wolverine Enameling Company, also of Detroit, the Parker name being retained unchanged. The assets of the consolidated companies amount to $1,500,000.

A new process known as "Bondering" has been developed by the Parker company. This process provides a primer base for the application of paint, enamel or lacquer to steel. The Wolverine company was acquired to provide suitable laboratories and works for carrying on experimental work in connection with this process.

National Chromium Corporation

National Chromium Corporation, 200 Varick Street, New York City, has instituted a group insurance program for its employees. Under the plan, the employees pay a small part of the cost of the insurance which provides for life, illness and accident policies. According to Sidney Satenstein, president of the company, this is probably the first job plating plant to install group insurance in the eastern part of the country.

Production of Aluminum in 1928

The value of new aluminum produced in the United States during 1928 was $47,899,000, an increase of 22 per cent as compared with 1927, according to a statement of the United States Bureau of Mines, Washington, D. C. The principal producing plant was that at Massena, New York, where approximately 45 per cent of the metal made in the United States was recovered. Other works are at Niagara Falls, New York; Alcoa, Tennessee; and Badin (Whitney), North Carolina.

The domestic price of new aluminum ingot 99 per cent pure, was 24.3 cents a pound during the entire year 1928. Prices outside metal 98-99 per cent pure held throughout the year at 23.9 cents a pound.

The record production of automobiles in 1928 and the wider adoption of aluminum pistons and connecting rods in the manufacture thereof combined to greatly increase the consumption of aluminum by the automotive industry in 1928. Aluminum furniture has come into a position of prominence rapidly, and many railroads have adopted aluminum chairs as standard equipment in their dining cars, and installations have also been made in offices and libraries. The use of aluminum in experimental work in railroad car construction and the equally prominent field of commercial truck body manufacture continued during the year. The use of aluminum bronze powder as a paint pigment, and of aluminum for screw machine parts, bottle caps, foil, and collapsible tubes showed a normal increase in consumption during 1928, and in the aircraft industry the rate of consumption of aluminum strong alloys is said to have trebled within the year.

Imports of aluminum metal, scrap, and alloy in 1928 were 48 per cent less in quantity than in 1927, and imports of hollow ware were 13 per cent less than in the previous year. Imports of plates, sheets, bars, etc., in 1928 decreased 93 per cent in quantity and "other manufactures" of aluminum decreased 11 per cent in value, as compared with imports of similar products in 1927.

Surface Combustion Company Expansion

Further expansion by the Surface Combustion Company, Toledo, Ohio, to take care of its increasing business is announced by Frank H. Adams, general manager. This company was taken over, enlarged and reorganized by the Henry L. Doherty Company some five years ago. It is rated as one of the largest manufacturers of gas burners and gas fired furnaces for industrial purposes in the country. It is now making an addition of 35,000 sq. ft., to its production plant, which, when completed, will give a combined floor area of 90,000 sq. ft. The plant includes an office, laboratory, factory and storeroom. The factory contains a machine shop completely equipped with up-to-date automatic machinery, a sheet metal department, refractory department, house heating burner assembly department, an assembly floor for steel fabrication and inspection and a shipping department. This company has branch offices in Chicago, Detroit, Boston, New York, Pittsburgh, Philadelphia, Kansas City and Birmingham.

Nonferrous Metals and Alloys

The United States Department of Commerce, Washington, D. C., announces that, according to data collected at the biennial census of manufactures taken in 1928, the establishments engaged primarily in recovering and refining secondary metals (from scrap and dross) in 1927 reported products valued at $80,770,546, a decrease of 1.7 per cent as compared with $82,137,523 reported for 1925, the last preceding census year. The establishments engaged primarily in rolling, drawing, and casting nonferrous metals (except aluminum) and their alloys and in producing such alloys (Babbitt metal, type metal, solder, etc.) in 1927 reported products valued at $581,568,767, a decrease of 2 per cent as compared with $593,555,540 reported for 1925.

The classes of establishments for which statistics are presented in this report are: (1) Those engaged in recovering and refining nonferrous metals and alloys from scrap and dross; (2) those engaged in the manufacture of alloys; and (3) those engaged in rolling, drawing, and casting nonferrous metals (except aluminum) and their alloys. Most of the products of these establishments are in the form of plates, rods, tubing, and mold castings, but they also manufacture considerable quantities of finished products, such as bearings and bushings, die castings, extruded shapes, forgings and hot pressed parts, ornamental grilles, railing, etc., and bells.

Hanson-Van Winkle-Munning Company

The Hanson-Van Winkle-Munning Company of Matawan, New Jersey, manufacturers of electroplating and polishing equipment and supplies, has recently made a number of changes in its sales organization. H. R. Smallman, for the past three years assistant to the sales manager, has been made manager of the Chicago office, with headquarters at 549 West Washington Boulevard. H. M. Cherry, who for the past seven years has represented the company in Michigan, has been made manager of the Detroit office, with headquarters at 5415 12th Street. Louis M. Hague, who for the past two years has represented the company in Western Pennsylvania, has been made manager of the Pittsburgh-Cleveland office, with headquarters at 106 Liberty Avenue, Pittsburgh, Pa., the territory comprising Ohio, Western Pennsylvania and West Virginia.

Statistics on Sales of Magnesium

The sales of magnesium produced in the United States in 1928 amounted to 483,000 pounds, valued at $587,000, as compared with sales of 366,400 pounds, valued at $441,700 in 1927, according to revised statistics of the United States Bureau of Mines, Department of Commerce, Washington, D. C. In a statement issued May 1, 1929, sales of 865,662 pounds, valued at $779,674, were reported, but further study of the returns indicates that these preliminary figures contain considerable duplication due to resales (by fabricators) of metal elsewhere reported as sales of ingot metal.

Seventy-one per cent of the magnesium sold in 1928 was in ingot form at prices ranging from 70 cents to 85 cents a pound, and such sales increased more than 37 per cent as compared with 1927. Sales of castings in 1928 were 55,860 pounds, an increase of about 75 per cent as compared with 1927. Sales of wire increased 61 per cent, but those of tubing decreased nearly 40 per cent as compared with 1927. Sales of sheet, which constituted 3 per cent of the total in 1927, amounted to slightly under 2 per cent of the total sales in 1928. The average price of domestic ingot metal in 1928 was 82 cents a pound, that of powder $1.51 a pound, and of castings $2.39 a pound.

Aluminum and Brass Company

The Aluminum and Brass Company, Lockport, N. Y., is planning an important expansion of its production, according to the president, A. F. H. Kohler. High pressure gas valves and high pressure gas containers will be produced in large quantities following the installation of new machinery needed in this production, it is announced.

Unique Brass Foundry in Merger

The Unique Brass Foundry, 833 Grant Street, Buffalo, N. Y., has been acquired by Hickman and Squire, formerly of 127 Fillmore Avenue, Buffalo. The acquiring company will operate the foundry hereafter, manufacturing metal machines for the handling of food products in the new property. The Fillmore Avenue plant of Hickman and Squire will be discontinued.

Scrap Metals Offered by Army

Approximately 3,779,671 pounds of scrap metals, including 114,138 pounds of scrap copper resulting from scrapping of shells, is offered in exchange for smokeless powder for the 75 mm. gun, model 1897, by the New Cumberland General Depot, New Cumberland, Pa. Bids stating the amount of powder offered for the metals are to be opened July 25, 1929. Complete data can be had from the office of the Ordnance Supply Officer at the New Cumberland Depot.

Business Reports of The Metal Industry Correspondents

New England States

Waterbury, Conn.

JULY, 1, 1929.

Leavenworth P. Sperry, formerly secretary of the company, was elected treasurer of the Scovill Manufacturing Company at a meeting of the directors last month. The office was recently made vacant by the death of **Clayton M. DeMott, Sr.** At the same meeting **Chauncey P. Goss** was elected vice president. **William M. Goss** was elected secretary of the company, the office made vacant by Mr. Sperry's promotion.

Mr. Sperry is a son of the late **Mark L. Sperry,** at one time president of the company. Chauncey P. Goss is the youngest son of the late **Chauncey P. Goss, Sr.,** for many years head of the company. He is a brother of President **E. O. Goss,** Vice President and General Superintendent **John H. Goss** and Vice President **George A. Goss.** William M. Goss is a son of President E. O. Goss.

Negotiations apparently are still in process for the acquisition of the **Randolph-Clowes Company** by the **American Brass Company** as officials of both companies do not deny that something is in the works but say nothing definite can be announced as yet. **Wilbur P. Bryant,** treasurer of the former concern, characterized reports that the merger had been completed as "premature." The concern, although small compared to the three leaders in the industry, is one of the best known in the brass business and makes a specialty of large size tubes. It has a casting shop, rolling, tube, wire and rod mills.

Commenting on the recent acquisition of the **Chase Companies, Inc.** by the **Kennecott Copper Corporation,** President **F. S. Chase** of the former said last month that the tendency in the future will be for the various copper mining and brass companies to be formed into larger and fewer groups and the market to become somewhat more stabilized and narrowed.

'It is to be hoped," he said, "that this will result in less danger of such erratic fluctuations as recently occurred when copper went to 24 cents. Such violent shifting of values tends to embarrass consumers who are frequently handling their product on a very narrow margin of profit. The merging of the Chase Companies in the Kennecott seemed a logical and natural step and would tend to make still more permanent the continued, active operation and of these properties here in Waterbury and under their present management and name."

Officials of the new Chase plant in Cleveland will be chosen from among the personnel of the Waterbury plant, it is stated.

President **E. O. Goss** of the Scoville Manufacturing Company has delivered the following tribute to the late **Clayton M. DeMott,** former treasurer of the company: "He was a most devoted husband and father and the loyalty of his friendship will ever be an outstanding remembrance to thousands of the people of Waterbury. No one survives him in the organization he served who was so universally known personally or so beloved as a friend to all. It was good to see his tall figure on the street or about the works and his kindly smiling and cheery greeting will be sorely missed by all his shopmates and associates."

Recommendations made to the federal bureau of labor by Commissioner **Ethelbert Stewart** for drastic regulation over the use of radium paint are already in effect at the **Waterbury Clock Company,** Supt. **C. H. Granger** says. The whole subject of radium poisoning, he says, is being investigated by the United States department of public health under the direction of Surgeon Gen. Cummings and it is expected his committees will approve many points recommended by Commissioner Stewart. Comissioner Stewart, however, in addition to his recommendations for drastic regulations as to the use of the paint, suggests the advisability of absolutely forbidding the use of radium paint in the manufacture of all luminous watch and clock dials. Several deaths have resulted in Waterbury among workers using the paint although no cases have developed since the new regulations have been put into effect. It was formerly believed that the cases started from workers wetting with their lips the brushes used for the work but Commissioner Stewart says deaths have resulted without this and merely from the radiation of the paint.

The **French Manufacturing Company** has at last won its fight against the zoning regulations. The aldermen have amended the zoning ordinance so as to put the land on which the company wished to build an addition in the industrial zone. In return, the company has agreed to have part of its property on which it does not care to build put in the residential zone.

Out of the $9,000,000 spent with Connecticut manufacturers during 1928 by the **Western Electrical Company** for materials used in making telephone equipment, $1,615,536 was spent in Waterbury for brass goods.

Elton S. Wayland, a vice president of the American Brass Company, has been appointed to the state commission which will have charge of building the new hospital for the insane at Newtown.

—W. R. B.

Connecticut Notes

JULY 1, 1929.

NEW BRITAIN—Directors of the **Stanley Works** at their meeting last month declared a regular dividend of 2½ percent and a special dividend of 2 percent to be paid July 1. Another extra dividend of 1 per cent will be paid August 15.

Directors of **Landers, Frary & Clark** voted the regular quarterly 3 percent dividend and an extra of 1 percent payable June 29, at their meeting last month. Directors of **North and Judd** voted to pay the regular 2 percent and an extra dividend of 1 percent on June 29.

Fafnir Bearing Company has acquired the **Railway Motor Corporation** business and a new subsidiary to be known as **Fafnir Bearings, Inc.,** will be organized to manufacture antifriction bearings for railroad rolling stock. The parent company started in 1911 with a capital of $100,000 and has now a capital of $3,000,000.

A fire in the staining department of the **Stanley Works** last month caused extensive damage to some of the machines but was extinguished by the factory's own fire department.

HARTFORD—Pratt & Whitney Aircraft Company has received a contract from the navy department for 25 motors for the new type of bombing plane it is having built.

Royal Typewriter stockholders will meet today to act on a recommendation that the no par value shares be split two for one. Preferred stockholders are to be given two votes for one in order to preserve the relative voting rights. The present number of common shares is comparatively small and therefore subject to wide fluctuation and the object of the change is to secure greater stability. Earnings in excess of $3.50 per share are expected for the first quarter of this year.

Stockholders of **Veeder-Root, Inc.,** will meet this month to act on amendments to the company's by-laws.

The **Billings & Spencer Company** has received a contract for delivery of three of the new Billings motor driven hammers to the **Spicer Manufacturing Company** at Toledo. The new hammer was designed during the past few months and since news of it has leaked out, executives of industries from various parts of the country have been here to look at it. It eliminates shafting, pulleys, belting and hangers.

BRIDGEPORT—The **Western Electric Company** during 1928 bought $1,162,689 worth of goods from Bridgeport manufacturers for the telephone trade.

Joseph J. Krist, secretary of the **Connecticut Automotive Specialties Company,** and of the **Casco Products Company,** has been sued by the latter company on the charge of embezzling $20,000. He was also fined $2,000 last month by the United States District court on the charge of falsifying income tax returns as secretary of the Automotive Specialties company, **Joseph Cohen,** president of the latter company, also charged with the same offense, pleaded not guilty and the case was continued indefinitely. The company reported losses instead of profits during 1925, 1926 and 1927, the government claiming a profit of $40,000 was made by the concern. The **Specialties Company** was also fined by the district court on this charge, the fine in its case amounting to $3,000.

The powder magazines at the **Remington Arms** plant exploded May 31, slightly injuring one man. The plant was undamaged except for the magazines as the latter are kept at some distance from the factory buildings. No fire resulted as the inflammable parts of the magazines were blown away.

A two days' session of sales managers of the **Dictaphone Company** was held here last month, 100 attending and making an inspection of the factory. **L. C. Stowell,** president of the company, declared at the dinner that the May sales were the highest in the history of the company. A feature of the gathering was the announcement of a sales contest between the sales force of Great Britain and Ireland as opposed to the sales force of the United States and Canada.

BRISTOL—The **E. Ingraham Company** will close July 4, for only one day and instead of the usual two weeks' vacation the company employes will be given a vacation from August 2 to August 19. Conditions at the plant are said to be better than a year ago.

NEW HAVEN—Three members of the Communist party appeared before the board of aldermen last month to demand improved working conditions and an investigation at the plant of the **Winchester Repeating Arms Company.** They based their complaint upon an explosion that recently caused the death of **Patrick Doherty** and the injury of **John W. Coogan** and **Fred Koeger.** They claimed the explosion was not an accident but that the employers were criminally negligent.

During 1928 the **Western Electric Company** spent $1,869,746 in this city for supplies for the telephone industry of which $1,685,926 was spent with the **New Haven Wire Company.**

TERRYVILLE—The sprinkler system in the heat treating department of the **Eagle Lock Company** started to operate one day last month without warning and caused several hundred dollars' damage. Excessive heat is thought to have melted the lead in the pipes. The Eagle Lock Company is discontinuing its former policy of maintaining rents for its employes and is selling all its one family houses.

TORRINGTON—An extra dividend of $1.25 in addition to the regular quarterly dividend of 75 cents a share was declared by the directors of the **Torrington Company** at their meeting last month. Both are payable July 1 to stock of record June 20.

MERIDEN—**The International Silver Company** directors have declared the regular dividend of 1 1-2 percent on the preferred stock of the company, payable July 1 to stockholders of record June 12. —W. R. B.

Providence, R. I.

JULY 1, 1929.

The month of June has been practically normal in the various branches of the metal trades for, while there has been the seasonable curtailment among the jewelry branches, the several building trades have shown a slight increase so that, on the whole, the month's business has been well balanced and encouraging. This might also be said of the year's business with the close of the first half year and the indications are equally encouraging for a continuance for an indefinite period. One outstanding feature of the month has been the consummation of the movement to organize the manufacturers of jewelers' findings into an association for mutual purposes.

There are thirty-four firms who have been found to be eligible to become members of the Association and of this number twenty-eight have already subscribed to the organization as charter members and the others have the matter under consideration so that the time for closing the charter list has been extended to the next meeting, which will be held in September. The name chosen for the new organization is The Metal Findings Manufacturers' Association and the following officers have been elected: President—**Frank E. Farnham,** of the Jewelers' Supplies Company; Secretary—**Ralph Gregory,** of Gregory & Goodwin; Treasurer—**William G. Lind,** of the T. W. Lind Company.

The Jeffries Corporation of Providence has been granted a charter through the Secretary of State's office under the laws of Rhode Island, to conduct a manufacturing jewelry business in metal products, with an authorized capital consisting of 500 shares of common stock of no par value. The incorporators are: **Thomas L. Marcaccio, Mark D. Jeffries and E. F. Singer.**

Stockholders of the **Gorham Manufacturing Company** at a special meeting held the past month, authorized the retirement of the balance of the company's preferred stock in the amount of $129,100 and also authorized the increase of 100,000 shares in the company's no par value common stock. These actions had previously been recommended by vote of the directors. The increase authorized in common stock was for the immediate purpose of allowing for the payment of a five per cent stock dividend voted earlier in the year to be payable June 3. The total authorized capital of the company, according to a certificate and an amendment to the company's charter filed with Secretary of State Sprague will henceforth be 282,000 shares. Under the Rhode Island tax laws, the increase of 100,000 shares is equivalent to $10,000,000 and makes the value of the total authorized capital, for purposes of taxation, $28,200,000. The amendment is signed by **Edmund C. Mayo,** president, and **H. C. Hoyt,** secretary of the Gorham Manufacturing Company.

The B. B. Jewelry Company has been incorporated under the laws of Rhode Island to deal in jewelry, with a capital stock of 100 common shares of no par value, the incorporators being **Judah C. Semenoff, Edmund J. Kelly** and **I. C. Hannaway,** all of Providence.

Joseph A. Smith, 225 South Main Street, Attleboro, has filed information at the office of the City Clerk of Providence that he is the owner of the electroplating business at 93 Sabin Street this city under the firm name of **Joseph A. Smith & Company.**

Harry L. Benson, electroplating, rear of 226 Eddy Street, has filed a voluntary petition in bankruptcy in the United States District Court for Rhode Island, the accompanying schedules showing liabilities aggregating $8,515 and assets of $4,052.

The Providence Metal Spinning Company, 185 Eddy Street, is owned and conducted by **George F. Culf** and **Frederick Culf,** according to their statement filed at the city clerk's office.

Harry M. Arabian, of 119 Armington Avenue, Edgewood, has filed a statement with the city clerk's office that he is owner of the **Catlow Manufacturing Company,** 71 Richmond Street, Providence.

The Celluloid Novelty Company, 756 Eddy Street, Providence, is being conducted by **Samuel Dosick,** of 202 Oakland Avenue, Providence and **Isadore Dosick,** of 24 St. Alban Road, Boston.

The **C. S. Lacquer Company** is having a one-story addition of brick erected at its plant 217 Chapman Street, Providence. It will be 50 x 61 feet and cost $12,000. —W. H. M.

Middle Atlantic States

Newark, N. J.

JULY 1, 1929.

The **Gilby Wire Company**, of 152 Riverside Avenue, is preparing for the erection of a large addition to its plant. The addition will about double the working space in the establishment, the ultimate floor space to be in the neighborhood of 40,000 square feet. To provide for the addition the company recently purchased an adjoining plot.

The **Raritan Copper Works**, Elm Street, Perth Amboy, N. J., is contemplating a three-story addition of brick and steel to cost in the neighborhood of $55,000.

The **New Jersey Copper and Chemical Company**, of 175 Smith Street, Perth Amboy, N. J., has been incorporated with 1,000 shares preferred stock and 5,000 shares of common stock without par value. **Charles B. Cohen, Louis Daltz and Solomon Dubrow**, all of Perth Amboy, are the incorporators.

The following Newark incorporations were chartered here: **Phil-Greene Manufacturing Company**, manufacturing lamps, $10,000; **William S. Rich & Son, Inc.**, manufacturing jewelry, $300,000; **Fluid Chemical Company, Inc.**, chemicals, $100,000; **National Ring Company, Inc.**, manufacturing jewelry, $100,000; **Othogen Laboratories, Inc.**, manufacturing chemicals, 100 shares no par; **Aumak Manufacturing Company, Inc.**, manufacture radio sets, $100,000; **The Matthews Corporation**, manufacture silverware, $125,000; **Keyless Lock Company**, $125,000, Newark, manufacture locks.

The Annandale Graphite Company, Annandale, N. J., will erect a two-story brick and steel addition to cost $40,000.

Vitalite Company, of Jersey City, has been chartered with 20,000 shares no par to manufacture metal cloth. **Herpers Brothers**, 18 Crawford Street, Newark, will erect a two story brick factory building for the manufacture of jewelry. The plant will cost $40,000. —C. A. L.

Trenton, N. J.

JULY 1, 1929.

The **Federated Metals Corporation** of this city has promised the Hamilton Township authorities that the gas menace which allegedly blighted plant and animal life in Whitehead Manor will be removed. **Kenneth Rossman**, manager of the Company informed the authorities that he had been spending some time in arranging for the installation of purifying devices. He said that scrubbing towers will be placed on the smokestacks of the plant, and that the gaseous smoke emanating from the smelters will be checked. Until the purifying device has been installed, operation of the plant will be discontinued, Rossman said.

Residents of the community declared that gases from the plant have blinded dogs, have killed trees and shrubbery and stripped paint from homes. It is also said that residents of the community suffered affliction of the eyes and throat.

Trenton metal plants continue to run to capacity. The **Jordan L. Mott Company** is operating five days a week and the prospects look well. The big **Roebling** plant is running overtime in different departments. The **Trenton Emblem Company** is now running normally.

The following concern has been incorporated here: **Insulated Duct and Cable Company, Inc.**, manufacture insulation for copper, brass, etc., 2,000 shares no par, Trenton, N. J. —C. A. L.

Middle Western States

Detroit, Mich.

JULY 1, 1929.

With spring past and summer just coming into its own, there is more or less evidence of a general slowing down of industrial conditions, not only in Detroit, but also in the manufacturing centers of the state as well. But this is a seasonal condition and is not causing much, if any concern. It probably will continue until around September 1, when there is every reason to believe fall activities will be resumed with vigor again. However, there still is plenty of activity, and production is substantial in all the non-ferrous metal plants in every part of the Detroit area. But like concerns engaged in other lines, there is a general slow-up, which always marks the summer months. This is shown particularly in the manufacture of motor cars, on which so many individual plants in the non-ferrous metal field depend.

By and large, the non-ferrous metal industry and the plating industry likewise are going into the summer months in a manner that is satisfactory and with an outlook that makes every one feel well.

Announcement is made of the recent election of **Charles B. Bohn** as director of the **Fidelity Trust Company**, at Detroit. The career of Mr. Bohn is perhaps best reflected in the phenomenal growth of the Bohn Aluminum & Brass Corporation. This corporation pioneered in the development of aluminum uses in the engineering field and, as a result, today makes the greater part of the pistons used in a vast number of the popular makes of automobiles.

Approval has been given by stockholders of the **Heywood Starter Company** and of the **Simon Airplane Acceptance Company**, both of Detroit, to the proposed plans for consolidation of these companies into a new corporation to be known as the **Sky Specialties Corporation**, with an authorized capital of 200,000 shares of no par stock. Officers of the new corporation are president, **Arthur L. Cash**; vice president, **F. L. Riggin**; secretary and treasurer, **Simon D. Den Uyl**. Directors include the foregoing officers and **Charles B. Bohn, William B. Stout, Stanley E. Knauss, Edward Roberts, S. L. McKay and John Cowan, Jr.**

The Bohn Aluminum & Brass Corporation, Detroit, it is announced, has declared an extra dividend of 50 cents a share and the quarterly dividend of 75 cents a share, both payable July 1 to stock of record of June 15. Business of this organization continues at a record pace.

The National Enameling & Stamping Company, Inc., reports the appointment of **J. F. Hahn**, as vice president and treasurer in charge of finance, and **Thomas W. Gulley** as vice president in charge of sales. Both appointments are the result of promotions, as Mr. Hahn and Mr. Gulley have been identified for many years with the company, which is known in Detroit through its branch office at the Book Tower in charge of E. J. Kolar.

J. C. Miller Company, 250 Pearl Street, Grand Rapids, has recently been incorporated with a capital stock of $75,000. It is engaged in the manufacture of polish and plating supplies, etc. The stockholders are **John C. Miller, Vernon J. Twyning** and **Bessie L. Miller**, all of Grand Rapids.

The Commerce Pattern Foundry & Machine Company, 2211 Grand River, Detroit, it is announced, has perfected and is producing a highly conductive copper casting which meets the requirements of manufacturers of electrical equipment. The development of this new and exclusive type of copper casting required several years of research work. Tests have demonstrated the superior quality of the casting and its practical use in the manufacture of electrical equip-

ment, it is stated. The Commerce Pattern Foundry & Machine Company operates a complete jobbing plant.
—F. J. H.

Toledo, Ohio

JULY 1, 1929.

Production in most of the non-ferrous metal plants in this area has been strong for a long time, but at the present time there are indications of a general recession, which is regarded as seasonal and had been anticipated. The plating industry is following about the same general trend. Production in every line, it is believed, is due for a much earlier resumption than has been the rule in past years, during the midsummer period.

There has been some decline in employment, but this is nothing unusual at this season of the year. In general the Toledo business situation is favorable, and much is expected from it for next fall and winter.

Announcement is made that the **Electric Auto-Lite Company**, of Toledo, has authorized a second expansion, program which it is estimated, will cost $100,000 over a period of 12 months and is designed to add greatly to the capacity of the **American Enameled Wire Company** plant at Muskegon, Mich. The Electric Auto-Lite, which has its main plant at Toledo, also operates the American Wire plant at Muskegon.
—F. J. H.

Cleveland, Ohio

JULY 1, 1929.

General business seems to be entering upon a season of recession, following some months of record breaking activities. This naturally includes the brass, copper and aluminum industries, the plating industries, and of course the automobile industry, also on which so many others depend for their activities. But this is only a natural condition and is not giving any concern because it is an experience they have had many times and is generally expected. However, everything points to an early resumption of activities in all these lines again, perhaps much earlier than was the rule a year ago.

Accessory plants engaged on production for the motor car trade have most decidely encouraging prospects for the early fall, and that means about the same thing for the winter months. Indications are the demands from the motor car industry will be even greater than they have been in past years.

Announcement is made of production on a one-piece, full-forge high heat resisting valve that is expected to take rank as one of the outstanding developments in the motor car industry at the plant of the **Diamond Motor Parts Company** in St. Cloud, Mich., purchased recently by the **Aluminum Industries, Inc.**, of Cincinnati. General offices of Aluminum Industries Inc., and the Diamond Motor Parts Company, it is stated, will be maintained in Cincinnati, with the St. Cloud plant operating exclusively as a manufacturing unit. The new valve will be promoted to car manufacturers through the Detroit office of the parent company. —F. J. H.

Illinois Notes

JULY 1, 1929.

The Andreasen Manufacturing Company was recently incorporated in Chicago with a capital of 400 shares non par value, to manufacture and deal in metals, specialties, materials, etc. Signers of the articles of incorporation are **Harry N. Andreason, Leroy E. Dahlberg** and **George H. Mamerow.**
—C. A. L.

Wisconsin Notes

JULY 1, 1929.

Directors of the **National Enameling and Stamping Company,** with headquarters in Milwaukee, recently declared a semi-annual dividend of $1. It will be payable August 1 to stockholders of record July 1. The company headed by A. J. Kieckhefer, resumed dividends last December with a $1 payment, after a lapse of nearly five years. Election of two new vice presidents was announced recently. They are **J. F. Hahn,** who will be vice president and treasurer in charge of finance and **Thomas W. Gulley,** vice president in charge of sales.

The Milwaukee Stamping Company, one of the pioneer metal trades plants of the city, has been enjoying a good business. The company now has more than 150,000 square feet of floor space. The company has its own tool and die making department, division for plating and spraying parts and for polishing. Present officers of the firm are **Edwin B. Bartlett,** president and treasurer; **Joseph Birbaum,** vice president; **T. F. Geraghty,** vice president; **B. A. Otten,** secretary; **Charles Parker,** assistant treasurer and assistant secretary and **Fred J. Miller,** assistant sales manager.

Charles W. Paeschke, Jr., vice president and secretary of **Geuder, Paeschke and Frey Company,** Milwaukee, manufacturers of tin and enameled ware and also contractors of sheet metal parts, was recently elected to the board of directors of the Sixth Wisconsin National Bank, Milwaukee.

The Racine Polishing and Plating Company at Racine, has changed its name to the **Racine Plating Company,** according to an amendment to its articles of incorporation recently filed in the office of the register of deeds. —A. P. N.

Other Countries

Birmingham, England

JUNE 17, 1929.

At the 9th annual general meeting of the British Non-Ferrous Metals Research Association held in London last month the principal subjects discussed were the proposals to establish the Association in its own headquarters, the growth of the development section and the new scale of grants promised by the department of Scientific and Industrial Research. "The Association has made very good progress," said **Thomas Bolton,** the chairman, "but we have to realize that we have come to the parting of the ways." With an income from subscriptions reaching nearly £10,000 a year the Association has sufficient to remain in being as a useful nucleus of research but the Department's new scheme for grants calls for a considerable expansion. Grants will be paid only on income in excess of a minimum subscription income fixed at about the present figure. **H. T. Tizard,** secretary to the Department of Scientific and Industrial Research, said the Association needed an income of £30,000 a year.

The autumn meeting of the Institute of Metals is to be held in Düsseldorf on September 9 to 12, and will be not only the first meeting of the Institute to take place in Germany but will also constitute the first gathering of metallurgists and engineers to be held in Germany since 1914. The conference is being held by invitation of the Verein Deutscher Ingenieure and of the Deutsche Gesellschaft für Metallkunde.

Members of the **American Foundrymen's Association** have come over to England in large numbers to attend the International Foundry Convention and the International Foundry Trades Exhibition held in conjunction with it. They are at present touring the various industrials districts of England and were in Birmingham a fortnight ago when they inspected two local foundries, filling in their spare time with sightseeing in the Shakespeare district. The visitors went to Sheffield where they saw the Grimesthorpe foundry of the English Steel Corporation, the works of Messrs. Newton Chambers & Co., Ltd., and the Brightside Foundry Co., Ltd.,

and the manufacture of cutlery, silverware, electroplate at Messrs. Walker & Hall's.

The violent fluctuations in the copper market have caused a good deal of disturbance to Birmingham manufacturers who use brass and copper as the chief raw material. As a rule the ingots used by many local works consist of re-melted scrap in a much larger proportion than new metal. Last year there was an increase in the world demand for copper and eagerness amongst Continental countries to buy up scrap, so that when the pinch came British consumers were obliged to pay high prices for new refined copper owing to the shortage of scrap. Prices of gas, steam and water fittings and cabinet brass foundry were put up 15 per cent. Now they have dropped 5 per cent. Copper has dropped in larger proportion within the last few weeks but the manufacturers say they are having to pay heavily for the shortage of scrap and they cannot afford more than a 5 per cent reduction.

The jewelry and silversmith trades of Birmingham are doing rather a quiet trade, although the improvement which took place last year is maintained. So many men have left the industry following a spell of bad trade that it is difficult to obtain labor of the right sort. In the electroplate industry some firms report a growing business with Canada which country is ever ready to purchase sound reliable articles especially when the design is of an attractive nature. The overseas business in fact is making up for the quietness of the home trade. Travelers as a rule report that the retailers' shops are overstocked and not disposed to place new business until the situation alters. The silversmiths are making great progress with the enameled silver articles which are now being displayed in various colors. In fact the possibilities in regard to enameled silverware are said to be limitless. Its introduction has enabled the producers to imitate the famous Japanese lacquer work. Her Majesty the Queen was very much interested in these goods which she saw displayed at the British Industries Fair in February. A.

Business Items–Verified

H. Kramer and Company, Chicago, Ill., operating smelting and refining works, has awarded contracts for a smelting plant to cost about $100,000.

Progress Novelty Casting Works has moved to larger quarters at 26 to 34 South Sixth Street, Brooklyn, N. Y., to accommodate its expanded business.

Thomas Maddock's Sons Company, Trenton, N. J., sanitary ware manufacturers, will build a 2-story addition, 80 by 100 ft., at cost of about $50,000 with equipment.

Quality Aluminum Casting Company, 1231 Lincoln Avenue, Waukesha, Wis., has plans for an 88 by 105 ft., two-story and basement addition. **A. G. Pankratz** is president and general manager. The company operates an aluminum foundry.

Bridgeport Brass Company, Bridgeport, Conn., has awarded contracts for a one-story, 40 by 120 ft. tube mill and storage building, to cost in the neighborhood of $100,000. **R. E. Day** is general manager. The plant will be at 884 Main Street, Bridgeport.

Beaver Manufacturing Company, 625 North Third Street, Newark, N. J., manufacturer of electrical wiring devices and equipment, plans construction of a $40,000, 2-story addition. Company operates tool room, cutting-up shop and stamping and soldering departments.

Searchlight Metals Manufacturing Company, Richmond, Va., manufacturers of specialties, Babbitt metal, etc., have awarded contracts for construction of two one-story units which will cost about $45,000 with equipment. The company operates a refinery and brass foundry.

Multiplex Display Fixture Company, 918 North 10th Street, St. Louis, Mo., contemplates construction of a factory addition 60 by 105 ft. in area, two stories, to cost about $40,000 with equipment. The company makes store equipment, operating casting, stamping, polishing, grinding, lacquering and tool departments.

Pennsylvania Bronze and Brass Company, Inc., announces that its offices are now located at 20th Street above Hunting Park Avenue, Philadelphia, Pa., and that the telephone numbers are now: Bell, Michigan 4170; Keystone, Park 4714. The company's brass foundry at 22nd and Master Streets will continue to operate as usual.

Erection of Structural steel has begun for the **Western Electric Company's** new $25,000,000 cable and insulated wire plant now being built by a force of approximately two hundred workmen under the supervision of The H. K. Ferguson Company, Cleveland engineers and builders, at Point Breeze, Md.

Copperweld Steel Company, Glassport, Pa., has formed a southeastern district comprised of Georgia, Alabama, Tennessee, Florida, Mississippi and part of Louisiana, with **P. A. Terrell** in charge as district manager. The office of this district is located in the American Traders Bank Building, Birmingham, Alabama.

The Linde Air Products Company, New York, reports that its new oxygen producing plant at 1000 West Washington Avenue Oklahoma City, Oklahoma, commenced operations on May 17th. **F. K. Buckalew** is superintendent of the new plant and **A. B. Curtis**, whose headquarters are at Dallas, Texas, is district superintendent.

The Kalbfleisch Corporation, New York City, chemical manufacturers, announce that its board of directors has approved a plan for consolidation of the company's assets with those of **The American Cyanamid Company**, also chemical manufacturers, the board of directors of which has similarly approved the plan. The Kalbfleisch company will continue, however, to operate as a separate unit, no change in management being contemplated.

Binks Manufacturing Company has been formed through reorganization of the former **Binks Spray Equipment Company**, at Chicago, Ill., and is engaged in manufacture of spray painting equipment and spray cooling systems. **Neil C. Hurley**, formerly head of the **Hurley Machine Company**, Chicago, and **J. F. Roche**, formerly vice-president of the **Apex Electric Distributing Company**, are now respectively president and executive vice-president of the Binks company.

The General Fireproofing Company, Youngstown, Ohio, office, store and home equipment manufacturers, have let a $300,000 contract for construction of an addition with 90,000 sq. ft. of floor space. This will be used for fabrication of aluminum office furniture made of sheets provided by the **Aluminum Company of America**, according to a statement by **C. H. Chapin**, who states also that reports current that the new addition would be covered with aluminum sheets were entirely unfounded.

Macdonald Metal Products Company, Ltd., Waterloo, Quebec, Canada, manufacturers of brass, white metal and iron goods, have just completed construction of a new foundry building, 80 by 220 ft., to be used for casting parts for toys, and also for housing the company's plating, enameling, cleaning and assembling departments for toys. The company owns and operates the **Macdonald Wire Goods Company** and the **Kilgore Manufacturing Company of Canada**. **J. A. Macdonald** is president.

Sky Specialties Corporation, Detroit, Mich., has been formed by the consolidation of the **Simon Airplane Appliance Company** and the **Heywood Starter Corporation**, both of Detroit. The company manufactures Heywood high pressure injection starters for airplanes and other aeronautical accessories. The officers of the company are **Arthur L. Cash**, president; **F. L. Riggin**, vice-president; **S. D. Den Uyl**, secretary and treasurer. The directors are the officers and Charles B. Bohn, president of Bohn Aluminum and Brass Corporation, Detroit; Edward F. Roberts, William B. Stout, Stanley Knauss, John Kowan, Jr., S. L. McKay.

Review of the Wrought Metal Business

By J. J. WHITEHEAD
President of the Whitehead Metal Products Co. of New York, Inc.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

JULY, 1, 1929.

The ordinary seasonal lull in buying, together with a degree of uncertainty which has manifested itself concerning the copper market generally, has resulted in a somewhat smaller volume of business during the month of June for the mills fabricating brass and copper rods, sheets, tubes and wire. There is no anxiety on the part of the fabricators concerning this situation as it is felt that, all things considered, business is in very good shape and there is no complaint with conditions generally.

Many consumers are running along on purchases which were made earlier in the year, and on which they are now taking deliveries. This factor alone would curtail buying to some extent at this particular time. It is generally recognized that buying will have to be resumed, but unless there is some rapid upward movement in the copper market it is probable that consumers will profit by the lesson which they learned recently, and that they will go back to the buying policy which had been in vogue for a great many years until this recent flurry changed the entire situation. In other words, unless some unforeseen circumstances cause a rapid upward movement in the price of copper ingot, buying will be done on a hand-to-mouth basis, and the purchasing arrangements will be less hysterical in their character.

It is not believed that there will be any price changes or any serious re-arrangement of price schedules during the next month or two, and there is nothing therefore to excite buyers into anticipation of requirements, which might result in bidding up prices again very shortly.

The business in nickel, Monel metal, and nickel and copper alloys still remains in satisfactory volume. Since there was no speculative buying movement in any of these metals, there has been no reaction of that sort possible, and the business continues to expand in a fashion quite consistent with the development which has been the rule for the past several years.

Producers of Monel metal are running their plants full, and the deliveries on nickel sheets, rods and tubes are very difficult to obtain. This delivery position does not apply to Monel metal which is in sufficient supply, but on special sizes of about 4 to 6 weeks is required in the ordinary course of business.

It is to be noted that practically all the factors in the industry are beginning to talk about a very prosperous and active Winter season with a general recognition of the fact that the possibilities are that the Summer months will be lacking in any outstanding feature. They will really be spent largely in the production of routine orders, and in preparation for the prosperous Fall to which the optimists are looking forward with a great deal of confidence.

Metal Market Review

By R. J. HOUSTON
D. Houston and Company, Metal Brokers, New York

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

COPPER

JULY, 1, 1929.

There were no surprising market changes of special importance in copper during June. Demand was maintained at a fair rate for export, but domestic buying was restricted to narrow requirements as measured by the notably buoyant condition of the market in the first quarter of the year.

The price tone of the market was steady to firm, but there were no aggressive movements to create any very radical tendencies. Consumers were extremely conservative. Brass and copper manufacturers and the public utility companies, however, are using exceedingly large tonnages of copper. Obviously this factor gives solid ground for optimism over the outlook for future developments.

With the latest announcement of an increase of 25,836,000 pounds in American surplus stocks of refined copper there is less fear of a preponderance of demand over supplies. This factor has led to a period of ease in the situation. Production was speeded up to new high records in the last three months. This growth in output attracted wide attention. There seems to be a determination not to produce greatly in excess of consumption, and action has been taken to curtail output to the extent of 10 per cent at some of the leading mines. Certainly it is obvious that market stability and confidence are always nullified by overproduction. Market tone was firm at 18 cents delivered to Connecticut Valley points and 18.30 cents c. i. f. European ports, with recent export buying the feature.

ZINC

Zinc prices made a slight gain in June, but there were no extraordinary factors to develop persistent activity and a distinctly upward trend to quotations. There was quite active buying early in June, and by the middle of the month prime western slab zinc was 6.65c. East St. Louis and 7c. at New York. The betterment in demand finally placed the market on the basis of 6.70c. East St. Louis and 7.05c. New York. The official price of ore has remained unchanged for many weeks at $44, with heavy stocks reported. Sales of ore have been less than output and a reduction in output would benefit the industry in view of an existent oversupply of both ore and slab. Production of slab zinc in May amounted to 56,958 tons, with total shipments of 57,720 tons, so that stocks in smelters' hands were reduced 762 tons. The tonnage in primary hands on June 1 was 33,826 tons. These are the smallest stocks in over two years.

TIN

Trading in tin developed greater activity lately. For a long time the market remained notably depressed, with consumers and traders hesitant. This was all in strong contrast to former rapid price changes of wide range and aggressive operations. Consumption has increased heavily, but world visible supply on June 1 was 24,765 tons, against 17,064 tons a year ago. Supplies are keeping ahead of demand, and in this situation a group of producers are reported to be ready to undertake the task of regulating output and stabilizing the price. Powerful British interests have been giving support to the market by heavy purchases, but notwithstanding the accumulation of a large tonnage supplies have increased and prices declined. Unless there is pronounced restriction of production the market appears likely to face a continued handicap. Early in June prompt Straits tin sold at 43½c. Future deliveries commanded a premium. A firmer tone prevailed at the month-end on indications of a producers' combine to conserve output. World supplies of tin for the first five months of this year amounted to 61,809 tons, against 51,874 tons for the corresponding months last year, an increase of 9,935 tons. New productive machinery is being installed at producing centers and a substantially higher output is apparent for 1929.

LEAD

A steady market has ruled for lead on the basis of 7 cents New York and 6.80 cents at St. Louis, with no indication of any important change near at hand. Consuming requirements have been consistently large in this country, and there are no signs of any serious recession in domestic outlets. Buying during the last of June was particularly good both in the East and West. Requirements for nearby and July were actively contracted for, with the booking of some orders for August shipment. Operations at the sources of production continue at a high rate. Output in the United States and Mexico totaled 90,504 tons in May as compared with 82,411 tons in April, an increase of 8,093 tons. Stocks of refined and antimonial lead in the United States and Mexico on June 1 amounted to 51,745 tons, being an increase of 12,351 tons compared with surplus stocks on May 1. The problem of overproduction is one that confronts many industries. Conservation efforts are needed in copper, lead, zinc and tin to hold down output to the basis of the rate of demand.

ALUMINUM

Consumption of aluminum continues in large volume, although in some quarters there appears to be a slight falling off from the peak record. The aircraft industry and the electrical trade are using large quantities of the metal. Inquiry from the automobile makers shows some slackening due to seasonal conditions, but other outlets are maintaining requirements at a high rate. English interests are reported to have sold over 3,000 tons of aluminum to the Russian government recently. United States imports of aluminum in the first four months this year amounted to 9,051,438 pounds, compared with 7,594,539 pounds for the same months last year and 22,133,069 pounds in the first four months of 1927. Prices for prime virgin ingot are without quotable change.

ANTIMONY

The condition of the antimony market is quiet and easy at about 8.90c. for spot duty paid and future positions 8.75c. to 8.87½c. Chinese producers are believed to be carrying large stocks and are also reported to be maintaining new output at an active rate. Meanwhile consumer demand is not specially urgent, and buyers generally are content to act leisurely in covering requirements. Warehouse stocks in bond on May 1 amounted to 2,060,032 pounds as compared with 2,335,431 pounds on April 1. Holders of bonded stocks have been carrying supplies for some time past in expectation of improvement in conditions for spot material. The high price for Chinese regulars this year was 9⅞c. and the low 8¾c. duty paid.

QUICKSILVER

There were sales of fair-sized quantities reported. Prices quoted range from $120 to $123 per flask of 75 pounds. There has been little change in the situation abroad, although stocks in Europe are said to be large.

PLATINUM

Refined platinum quotes $63 to $64 per ounce. Movements in the product are routine and without special significance.

SILVER

The silver situation has been under the shadow of depressing conditions for many months. China and India have been operating in the market to a limited extent. Demand, however, has been too apathetic to overcome the adverse tendency. The price of bar silver dropped to 51⅝c. early in June, which was the lowest in over two years. There has been very little worth-while support since, though the quotation at this writing is 52⅜c. Mines that produce silver as a by-product of copper, lead and zinc do not feel the pinch of low prices as much as mines producing primarily silver ores. Conditions are rather gloomy in Mexico, and the situation has become so discouraging in that country that a large group of mining companies may be forced to shut down or reduce output at prevailing prices.

OLD METALS

Trading in selected copper grades was quite active on domestic demand in June at steady prices. Export buying was also in good volume. A fair degree of confidence was in evidence, and total tonnage involved in transactions was large. There was considerable competition for supplies by foreign purchases, and the home trade was compelled to raise their bids on No. 1 copper and wire. Recent deliveries to refineries were extra heavy, and the movement in scrap copper for several weeks has been specially important. Heavy scrap copper and wire quotes 15½c. delivered. Dealers buying prices are quoted at 15¼c. to 15½c. for crucible copper, 12¼c. to 12½c. for light copper, 8c. to 8¼c. for heavy brass, 11c. to 11¼c. for new brass clippings, 4¾c. to 5¼c. for heavy lead, and 17¼c. to 18c. for aluminum clippings.

Daily Metal Prices for the Month of June, 1929

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	3	4	5	6	7	10	11	12	13	14	17	18
Copper c/lb. Duty Free												
Lake (Del.)	18.125	18.125	18.125	18.125	18.125	18.125	18.125	18.125	18.125	18.125	18.125	18.125
Electrolytic (f. a. s. N. Y.)	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Casting (f. o. b. N. Y.)	17.25	17.25	17.25	17.25	17.25	17.25	17.375	17.375	17.375	17.375	17.375	17.375
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.												
Prime Western	6.55	6.55	6.55	6.55	6.60	6.60	6.60	6.60	6.65	6.65	6.65	6.675
Brass Special	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.75	6.75	6.75	6.80
Tin (f. o. b. N. Y.) c/lb. Duty Free												
Straits	43.875	43.70	43.50	43.75	44.00	44.75	44 50	44.25	43.625	43.70	44.50	44.50
Pig 99%	43.00	42.875	42.75	43.00	43.25	44.375	44.125	44.00	43.125	43.125	44.00	43.875
Lead (f. o. b. St. L.) c/lb. Duty 2¼c/lb.	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80
Aluminum c/lb Duty 5c/lb.	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb.												
Ingot	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	35	35	35	35	35	35	35	35	35	35	35	35
Antimony (J. & Ch) c/lb. Duty 2c/lb.	9.00	8.85	8.85	8.85	8.85	9.00	9.00	8.875	8.875	9.00	8.875	8.875
Silver ¢/oz. Troy Duty Free	52.375	51.625	52.125	51.75	52.125	52.375	52.375	52.75	52.625	53.00	52.75	53.00
Platinum $/oz. Troy Duty Free	64	64	64	64	64	64	64	64	64	64	64	64

	19	20	21	24	25	26	27	28	High	Low	Aver.
Copper c/lb. Duty Free											
Lake (Del.)	18.125	18.125	18.125	18.125	18.125	18.125	18.125	18.125	18.125	18.125	18.125
Electrolytic (f. a. s. N. Y.)	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Casting (f. o. b. N. Y.)	17.375	17.375	17.375	17.375	17.375	17.375	17.375	17.375	17.375	17.25	17.338
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.											
Prime Western	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.55	6.641
Brass Special	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.70	6.753
Tin (f. o. b. N. Y.) c/lb. Duty Free											
Straits	44.625	44.75	44.70	44.625	44.375	44.50	44.45	44.625	44.75	43.50	44.265
Pig 99%	44.00	44.25	44.25	44.125	43.875	44.00	44.00	44.125	44.25	42.75	43.706
Lead (f. o. b. St. L.) c/lb. Duty 2¼c/lb.	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80
Aluminum c/lb Duty 5c/lb.	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb.											
Ingot	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	35	35	35	35	35	35	35	35	35	35	35
Antimony (J. & Ch) c/lb. Duty 2c/lb.	8.875	8.95	8.90	8.90	8.75	8.70	8.65	8.65	9.00	8.65	8.864
Silver c/oz. Troy Duty Free	52.625	52.625	52.50	52.25	52.375	52.25	52.375	52.50	53.00	51.625	52.419
Platinum $/oz. Troy Duty Free	64	64	64	64	64	64	64	64	64	64	64

Metal Prices, July 8, 1929

NEW METALS

Copper: Lake 18,125. Electrolytic 17,875. Casting 17,375.
Zinc: Prime Western, 6.70. Brass Special, 6.80.
Tin: Straits, 45.125. Pig, 99%, 44.50.
Lead: 6.75. **Aluminum,** 24.30. **Antimony,** 8.25.

Nickel: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
Quicksilver: flask, 75 lbs., $121. **Bismuth,** $1.70.
Cadmium, 95. **Cobalt,** 97% $2.60. **Silver,** oz., Troy, 52.25
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $64.00.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	13 to13½
Brass Ingots, Red	16 to16¼
Bronze Ingots	17¼
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	28 to40
Manganese Bronze Ingots	16 to21
Manganese Bronze Forging	36 to44
Manganese Copper, 30%	30 to40
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16½to19¾
Phosphor Bronze	19 to22
Phosphor Copper, guaranteed 15%	22½to25
Phosphor Copper, guaranteed 10%	21½to24
Phosphor Tin, no guarantee	55 to70
Silicon Copper, 10%, according to quantity	30 to35

OLD METALS

Buying Prices		Selling Prices
15¼to15½	Heavy Cut Copper	16¼to16½
14 to14½	Copper Wire, mixed	15 to15¼
12½to13¼	Light Copper	13½to14½
12 to12½	Heavy Machine Composition	13 to13½
8½to 9	Heavy Brass	9½to10
7 to 7½	Light Brass	8 to 8½
9½to10	No. 1 Rod Brass Turnings	10½to11
11¼to11¾	Composition Turnings	12¼to12¾
5⅜to 5⅝	Heavy Lead	6⅛to 6⅜
3¼to 4¾	Zinc Scrap	4¼to 5¾
8 to 8½	Scrap Aluminum Turnings	12 to12½
11½to12	Scrap Aluminum, cast alloyed	15½to16
17 to18	Scrap Aluminum sheet (new)	20 to21
29 to31	No. 1 Pewter	34 to37
20 to21	Old Nickel Anodes	22 to23
20 to23	Old Nickel	22 to25

Wrought Metals and Alloys

COPPER SHEET

Mill shipment (hot rolled) .....27¾c. to 28¾c. net base
From Stock .....28¾c. to 29¾c. net base

BARE COPPER WIRE

19⅝c. to 19⅞c. net base, in carload lots.

COPPER SEAMLESS TUBING

29¼c. to 30¼c., net base.

SOLDERING COPPERS

300 lbs. and over in one order .....26¼c. net base
100 lbs. to 200 lbs. in one order .....26¾c. net base

ZINC SHEET

Duty sheet, 2c., per pound — Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 8 per cent discount .....10.25 net base
Casks, jobbers' price .....10.50 net base
Open casks, jobbers' price .....11to11.50 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 gr., base price, ton lots.....33.30c.
Aluminum coils, 24 ga., base price, ton lots.....31.00c.

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	53c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 10½c. over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver 54c. to 56c. per ounce, Troy.

BRASS MATERIAL—MILL SHIPMENTS

In effect April 16, 1929
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb. High Brass	Low Brass	Bronze
Sheet	$0.23¼	$0.25	$0.26¼
Wire	.23¾	.25½	.26¾
Rod	.21¼	.25¾	.27
Brazed tubing	.30⅞	....	.35⅞
Open seam tubing	.31¼	....	.34¼
Angles and channels	.31¼	....	.34¼

BRASS SEAMLESS TUBING

28¼c. to 29¼c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	25¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")	24c. net base
Muntz or Yellow Rectangular sheet other Sheathing	25c. net base
Muntz or Yellow Metal Rod	22¼c. net base

Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	31⅜c.	10% Quality	34⅛c.
15% Quality	33c.	15% Quality	37¾c.
18% Quality	34¼c.	18% Quality	41c.

MONEL METAL, SHEET AND ROD

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs. 25c. over. Prices f. o. b. mill.

Supply Prices, July 8, 1929

ANODES

Copper: Cast	28c.	per lb.	**Nickel:** 90-92%	45c.	per lb.
Rolled, oval	27c.	per lb.	95-97%	47c.	per lb.
Rolled, sheets, trimmed	27¾c.	per lb.	99%	49c.	per lb.
Brass: Cast	27c.	per lb.	Silver: Rolled silver anodes .999 fine are quoted from 55½c., to 57½c., Troy ounce, depending upon quantity.		
Zinc: Cast	12½c.	per lb.			

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & Over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68 Unbleached	$27.06to$29.00
14" 20 ply 64/68 Unbleached	35.59to 37.65
12" 20 ply 80/92 Unbleached	30.70to 34.16
14" 20 ply 80/92 Unbleached	41.60to 46.09
12" 20 ply 84/92 Unbleached	39.31to 42.90
14" 20 ply 84/92 Unbleached	57.60
12" 20 ply 80/84 Unbleached	38.35to 39.37
14" 20 ply 80/84 Unbleached	52.00to 53.12
Sewed Pieced Buffs, per lb., bleached	40c. to 73c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.14-.19
Acid—Boric (Boracic) Crystals	lb.	.08½
Chromic, 75 and 125 lb. drums	lb.	.20½-.21
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls.	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.16¾-.21¼
Denatured, drums	gal.	.45-.57
Alum—Lump, Barrels	lb.	.03¼
Powdered, Barrels	lb.	.039
Aluminum sulphate, commercial tech	lb.	3.3
Aluminum chloride, solution in carboys	lb.	.06½
Aluminum—Sulphate, tech., bbls.	lb.	.33
Sulhpocyanide	lb.	.65
Arsenic, white, kegs	lb.	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls.	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.25
Chromic Sulphate	lb.	.30
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.21½
Cyanide (100 lb. kgs)	lb.	.45
Sulphate, bbls.	lb.	6.7
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$70.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13¾
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry bbls.	lb.	.35
Chloride, bbls.	lb.	.20
Salts, single, 300 lb. bbls.	lb.	.13
Salts, double, 425 lb. bbls.	lb.	.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash, Caustic Electrolytic 88-92% broken, drums	lb.	.09
Potassium Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 96-98%	lb.	.06¾-.07
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05½
Silver Chloride, dry, 100 oz. lots	oz.	.45
Cyanide (fluctuating)	oz.	.55-.57½
Nitrate, 100 ounce lots	oz.	.39
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.18
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls.	lb.	.04¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.32½
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.35
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03½